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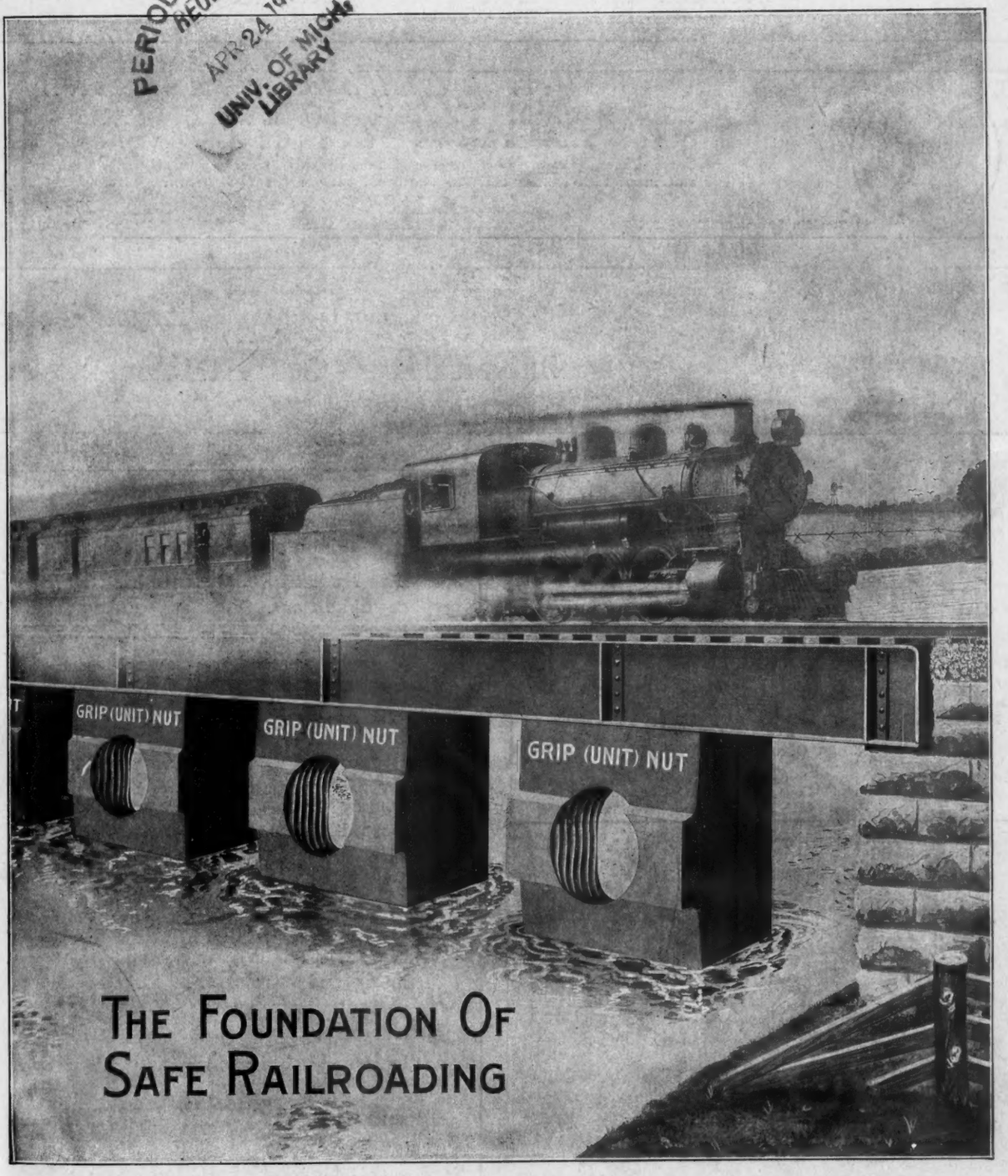

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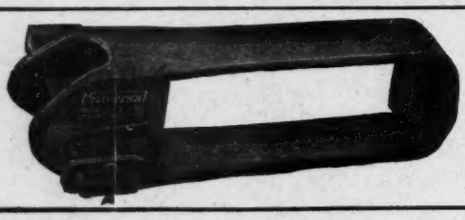

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Railway Age Gazette

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The Boston & Maine Situation

The attempt by a minority of the minority stockholders of the Boston & Maine to use the Massachusetts legislature to block the plans for reorganization of that company appears to be indefensible. A bill was passed last year by the Massachusetts legislature under the provisions of which a plan of reorganization with or without receivership could be worked out for the Boston & Maine and its leased lines. The plan that was worked out had certain features which were unusually fair and square to the holders of small blocks of stock whose ability to pay an assessment might be limited. Each stockholder had the right either to pay the assessment and receive new preferred stock, borrow the money which the reorganization committee had made arrangements to loan and to pay the assessment, or forfeit a certain part of his holdings and pay no assessment. If an assessment is necessary certainly nothing could be fairer than this way of making it. A small minority of the minority stockholders—the majority stock is held by trustees appointed with the consent and at the instance of the federal government—have been urging the Massachusetts senate to annul last year's permissive legislation. Recently the lower house of the legislature annulled this so-called Boston & Maine reorganization bill, but the senate on Tuesday refused to do so. The interests which are attempting to make a railroad with a decent financial credit and capable of giving satisfactory service out of the Boston & Maine have had to try to line up four states —Massachusetts, New Hampshire, Vermont and Maine. The New Hampshire legislature has not yet come into line, but the others had—Massachusetts, by passing its Boston & Maine reorganization bill, had done its part to make reorganization possible. Nothing could be a more pernicious use of government regulation of railroads than to play off one state legislature against another in an attempt to hold up constructive reorganization plans unless there were some wrong being done to minority interests which could be righted in no other way. So far the Boston & Maine minority has not made out any case to show that this was a fact in the Boston & Maine reorganization.

Coming Out of the Woods

There is a letter from a small investor which was written to Howard Elliott, president of the New York, New Haven & Hartford, published elsewhere in this issue, which ought to be read by everyone who reads the figures taken from the annual reports of the three principal New York Central Lines which also appear in this issue. The letter makes the point that whereas the shipper by railroad and the traveller both have government protection, the investor is entirely without protection. The New York Central Lines made a fine showing in 1915 and the operating managements are entitled to all the credit which a recitation of the figures shows belongs to them. No one, however, should jump to the conclusion that because the New York Central Railroad Company earned a surplus of $15,000,000 above its dividend requirements it is now in a state of prosperity comparable to a war bride. It is carrying on its balance sheet nearly $7,000,000 discount on funded debt, the result of the sale of $100,000,000 debentures, the proceeds from which sale was used to pay off floating debt. There is still $22,000,000 of floating debt to be taken care of by the New York Central Railroad Company, over $4,500,000 of floating debt of the Michigan Central, and over $8,000,000 of floating debt of the Cleveland, Cincinnati, Chicago & St.

Louis. With bad luck, or without extraordinarily strong banking support, the New York Central situation might easily have become exceedingly serious, with consequences to the hundreds of thousands of people whose savings are directly or indirectly invested in New York Central securities that would have been deplorable. The New York Central not only needs the surplus which it earned this year, but it needs at least another year and it ought to have more of equally great net earnings to put itself in the sound position which is so desirable from every point of view. To obtain these net earnings it is essential that the company have the co-operation of state commissions, the Interstate Commerce Commission, its patrons and its public, and it must be kept free from labor troubles.

THE FUNCTION OF THE DISTANT SIGNAL

THE Interstate Commerce Commission's report on the Milford collision, published in the *Railway Age Gazette* on April 7, page 792, says (1) that passenger trains should not be run so close together, as they were in this case, if dependence is to be placed on the flagman; (2) that there appears to be no reason why these trains, No. 79 and No. 5, should not have been started from New Haven ten minutes apart; (3) that a train (in a case like this) should immediately slacken speed on passing a caution signal and that the rules should require this; and (4) that where trains are run at high speed, close together, automatic stops should be used.

The third one of these recommendations—that trains should always slacken speed at the distant signal—is of particular interest at this time because of the discussions which are going on in connection with the action concerning signal rules which was taken at the last meeting of the American Railway Association (Chicago, November 17) which action—the adoption of the signal rules, Numbers 301 to 685, inclusive, quoted in part in the *Railway Age Gazette* of April 7, page 782—some of the minority are going to try to have reconsidered. Inspector Belnap's recommendations concerning distant-signal practice coincide with their views. The views of C. C. Anthony, assistant signal engineer of the Pennsylvania Railroad, on this subject, as expressed in his series of articles now running in the *Railway Age Gazette* are of the same tenor. It will be well to get the issues clearly in mind.

By way of leading up to his expression of opinion, Inspector Belnap asked questions concerning distant signal practice of all the officers and enginemen who appeared before him in the Milford investigation (and he did the same in his inquiry at Cleveland concerning the collision at Amherst, Ohio). His report shows that some of the New Haven runners do and some do not deem it necessary to shut off steam at a cautionary signal. It would, perhaps, be more accurate to say that some of them were not very precise in their definitions of what they would or would not do under given circumstances. The understanding of the engineman of the standing train (No. 79) was that, on finding a distant signal at caution, "the speed of the train must be reduced immediately and not again accelerated until the track is indicated to be clear by the next signal." The engineman of the freight that was passing on the adjoining track, thought that "enginemen are not necessarily required to reduce speed, but must approach the next home signal prepared to stop if it is found to be in the stop position." An officer stated that this was the case "under the rules."

As to the advisability of a rule which would require enginemen to shut off steam and begin to reduce speed at a caution signal, an officer stated that, while he was in doubt as to whether such a rule would add any factor of safety to train operation, there was no anxiety on the part of the officers regarding the congestion which might result from the operation of such a rule; and there should be none, as far as the men employed in train service are concerned, regarding the question of time. He did not believe that, as a matter of everyday practice, the application of such a rule would be felt, one way or the other, under a properly arranged automatic signal system; although with signals two or three miles apart, a man could hardly be expected to follow the same rule. In the last three years, he said, the importance of the distant signal had been emphasized on the New Haven road just as strongly and vigorously as it could be. He told of the efficiency tests (as reported in the *Railway Age Gazette*, March 3, page 385), and said that 2,410 of these tests had been made on the distant signal at caution. It is not stated, however, what action is expected of the engineman at distant signals, or what is the evidence that the signal is observed in these tests.

As already reported, the conclusion of the inspector is that the direct cause of the collision was the failure of the engineman on the second train properly to observe and be governed by the indications of the two automatic block signals in the rear of the standing train—one at caution and the other at stop. In all probability, as shown by calculation of the relative movement of the two trains, this engineman had passed several signals, at caution, while continuing to run at fairly high speed.

It is quite obvious that to make a practice of shutting off steam at every caution signal would tend to prevent an engineman from forgetting a caution indication altogether after passing the signal. The government inspector does not, of course, base his present opinion on the Milford case alone. If he reads the monthly returns of collisions filed in the office of the Interstate Commerce Commission, at Washington, he finds other cases, in plenty, of the same kind of error (but without the disastrous consequences). Every railroad officer knows the situation; and every railroad manager should squarely face the question, Is the automatic train stop the only remedy? Mr. Anthony takes substantially the same view as the representative of the government.

With so many hundreds of miles of railway equipped with signals two miles or more apart, and in view of the need of providing for heavy and slow trains which cannot be allowed to slacken speed at every caution signal; and in view, moreover, of the obstacles to the enforcement of a rule of this kind under adverse conditions, the proposed change in the requirement cannot, by any means, be looked upon as a complete preventive of overrunning stop signals; but, on the other hand, automatic stops would not be so insistently urged, either by the Interstate Commerce Commission or by other interests, but for the fact that disastrous collisions do continue to occur with disturbing frequency. Cases like Milford and Amherst are disturbing, however infrequent they may be, *comparatively*. On the best roads, everywhere—America, England, or anywhere—safety breaks down often enough so that no one can escape the conviction that our most perfect visual signals, with the best enginemen thus far found, and the most systematic efficiency testing, still fail to accomplish all that is desired.

The proposal to require more definite cautionary action on the part of the engineman at caution signals may be looked upon as a proposal to defer the necessity of using automatic stops. Mr. Belnap does not put it exactly in that way; nor does Mr. Anthony say so, in so many words; but everybody who examines the automatic stop problem with care must recognize its numerous difficulties, and the strength back of the present proposal consists largely of the officers of roads like the Atchison, Topeka & Santa Fe and the Missouri Pacific who, judging by what was said at the Chicago meeting, last November, believe that this is an immediate problem, demanding decisive action. They deem it important whether the automatic stop problem is or is not a question of the immediate future.

And the change from the present rule, to that proposed, is

easily enough made. A manager who is reluctant could safely try it, merely as an experiment. Many enginemen follow the proposed new rule already. The runner of a fast passenger train has two objects always in view; to get to destination on time and to make a smooth run. This second object is by no means unimportant; and one of the essential things to do in accomplishing it is to drop back far enough behind the preceding train to get all distant signals clear. Why not require that a fast train shall never pass a second or third caution signal at more than 15 miles an hour?

SPEEDING UP WAGES TO BENEFIT SHIPPERS

THE train service employees are not demanding an "eight-hour basic day" involving a $100,000,000 increase in their wages for their own benefit. They are seeking it for the benefit of the public. This has been made clear by numerous statements which have been issued by the leaders and the publicity bureau of their brotherhoods. Practically all the benefits the public was to receive were completely disguised until the spokesmen of the labor brotherhoods ingeniously and ingenuously disclosed them to its astonished view.

The most completely and profoundly disguised of all, however, was a boon which the inspired "Transportation Brotherhoods' Publicity Bureau" has now shown is to be conferred on "the public who ship and receive freight." "In these days of keen competition and quick changes of styles in manufactured goods," says an alluring statement recently issued by this bureau, "merchants are sadly handicapped by the fact that freight shipments are so slow that the styles change and discounts are lost through delay in receiving goods. . . . If trains were moved more rapidly cars would reach their destination, be unloaded and put back in service quicker." The way in which this expedited movement of cars is to be secured is, of course, pointed out. "The train crews in asking for a basic eight-hour day means (*sic*) that freight trains must make an average of 12½ miles per hour in order to avoid payment of overtime, instead of the 10 miles per hour as at present." To be more specific, if you speed up the regular wage per hour of the employees 25 per cent and their overtime rate per hour 87½ per cent, and cause overtime to begin after 8 hours instead of after 10 hours, the railways will speed up their trains 25 per cent per hour, and thereby a great benefit will be conferred on the shippers.

We have a criticism to offer regarding this philanthropic plan. It is not generous enough. Why not speed up the regular hourly pay of the employees 100 per cent, have overtime begin at the end of 5 hours, and increase the overtime rate per hour 200 per cent? Then, on this excellent theory, the railways would run all their freight trains 20 miles an hour, which would be at least four times as great an improvement, from the standpoint of both the employees and the shippers, as the one which the employees propose. The employees show that some freight trains now run 12½ miles an hour, and base on this the conclusion that it is feasible to run them all at this rate. We can show that some freight trains now run 20 miles an hour, which shows, of course, that it is practicable to run them all at this rate.

However, we have a still better suggestion to make. There are passenger trains which run 50 miles an hour, and even faster. Is there any good reason when passenger trains can be run this fast why freight trains should not make equal speeds? The employees say that the only reason why many freight trains now run only 10 miles an hour or less is that the companies load them heavily, and that all that is necessary in order to enable them to be run faster is to lighten their loads. By the same line of reasoning it can be shown that there is no reason why all freight trains should not be run 50 miles an hour. All that is necessary in order to do basis of 100 miles or less, 2 hours or less, would enable every railway train service employee to earn a day's wage in 2 hours; and think what good service it would cause the shippers to be given!

There is really only one thing the matter with this whole argument. This is, that it is so asinine that the long ears of the man who wrote it can be seen sticking through the pages of his manuscript. We sometimes wonder whether the spokesmen of the train service brotherhoods are really as distressingly ignorant of the facts regarding railway operation and the principles of railway economics as their published utterances indicate, or whether they are merely trying, in a very clumsy way, to fool other people. Some of the reasons why the adoption of the "eight-hour basic day" plan would not be of such "great benefit to the public who ship and receive freight" are as follows:

In the first place, the employees in freight service who work the longest hours per day are not those who run long trains. They are the employees who run way freight trains, and the reason why their hours are relatively long is that their trains have to make numerous stops at local stations to set out and get freight. Speeding up the wages of the employees could not reduce the time these trains are on the road.

In the second place, it is not a fact that merchandise is handled on slow tonnage trains. It is handled on the relatively fast freight trains to which the employees themselves direct attention as making over 12½ miles an hour.

In the third place, it is no more feasible to run all through freight trains as fast as the fastest freight trains than it is to run all freight trains as fast as passenger trains. The railways have a great variety of commodities to handle. Some, such as dry goods, are highly valuable, while others, such as livestock, fruits and vegetables, are highly perishable, as well as valuable. It is not only desirable to transport these in trains which run at relatively high speeds and which therefore are relatively short trains, but it is also feasible, because they can bear the relatively high rates which their high cost of transportation makes necessary. At the opposite extreme are commodities such as grain, lumber and coal, which are relatively nonperishable, and are of smaller value in proportion to their bulk. They cannot bear high freight rates; and because of their character there is no particular advantage in transporting them rapidly. To keep down the cost of transporting them they are handled in long, slow trains, and because the cost of transporting them is kept down the rates charged on them are low. The average rate per ton per mile on dry goods in this country probably is at least 2 cents. On livestock it is 12.6 mills; on cotton, 18 mills; and on dressed meats, 9.7 mills. The averages on some commodities which are handed in long and relatively slow trains are: Lumber, 6.98 mills; grain, 6.39 mills; anthracite coal, 6 mills; bituminous coal, 4.57 mills. The growth of the tonnage of cheap and bulky commodities is much greater than that of other commodities, and the railways took advantage of this to effect great economies by increasing their average tons per train.

Now, what does the proposal of the employees that many freight trains shall be run faster in order that their wages may be speeded up really mean? It means that lumber, coal and grain are to be hauled in trains as short as those which haul dry goods, livestock and dressed meats, the result of which would be to make the cost of transporting lumber and coal as great as the cost of transporting dry goods and livestock. But if the cost were as great the rates for the service would have to be as high. It would be a great boon to the shippers of bituminous coal to have the speed of the trains in which their coal is hauled increased, and the average rate on it advanced from 4.57 mills to 9 mills or 1 cent, wouldn't it? It would be a great advantage to the farmers to have the trains in which their grain is hauled increased, and the average rate on it advanced from 6.39 mills to, say, 12.6 mills, which is the present rate on livestock, wouldn't it?

The shippers of the United States may well remember the old adage to beware of Greeks who come bearing gifts. The

increases in wages which the train service employees already have secured are mainly responsible for the advances in freight rates which already have had to be made; but all the past increases in rates are negligible compared with those which will have to be made if their present demands, or any large part of them, are granted.

HAND BRAKES ON MOUNTAIN GRADES

LEGISLATION requiring the use of air brakes on freight cars was enacted primarily in the interests of safety to the trainmen and not to facilitate railway operation, although the inventor and the railroads had both purposes in view in developing the air brake. In the decision of the United States court of appeals, Ninth district, which was noticed in the *Railway Age Gazette* of April 7, 1916, the court used this language in one of the sentences in the summary of its opinion:

> The language of the act was equivalent to declaring that after the date named, freight trains should not only be equipped to run, but should actually be run without requiring brakemen to use the common hand brake.

In the first sentence of this summary, however, we find this statement:

> It was the intention of Congress by the power brake provision of the safety appliance acts (27 Stat. 531; 29 Stat. 85; 32 Stat. 943) to make it unlawful to require brakemen to use hand brakes in the ordinary management and movement of freight trains in interstate commerce.

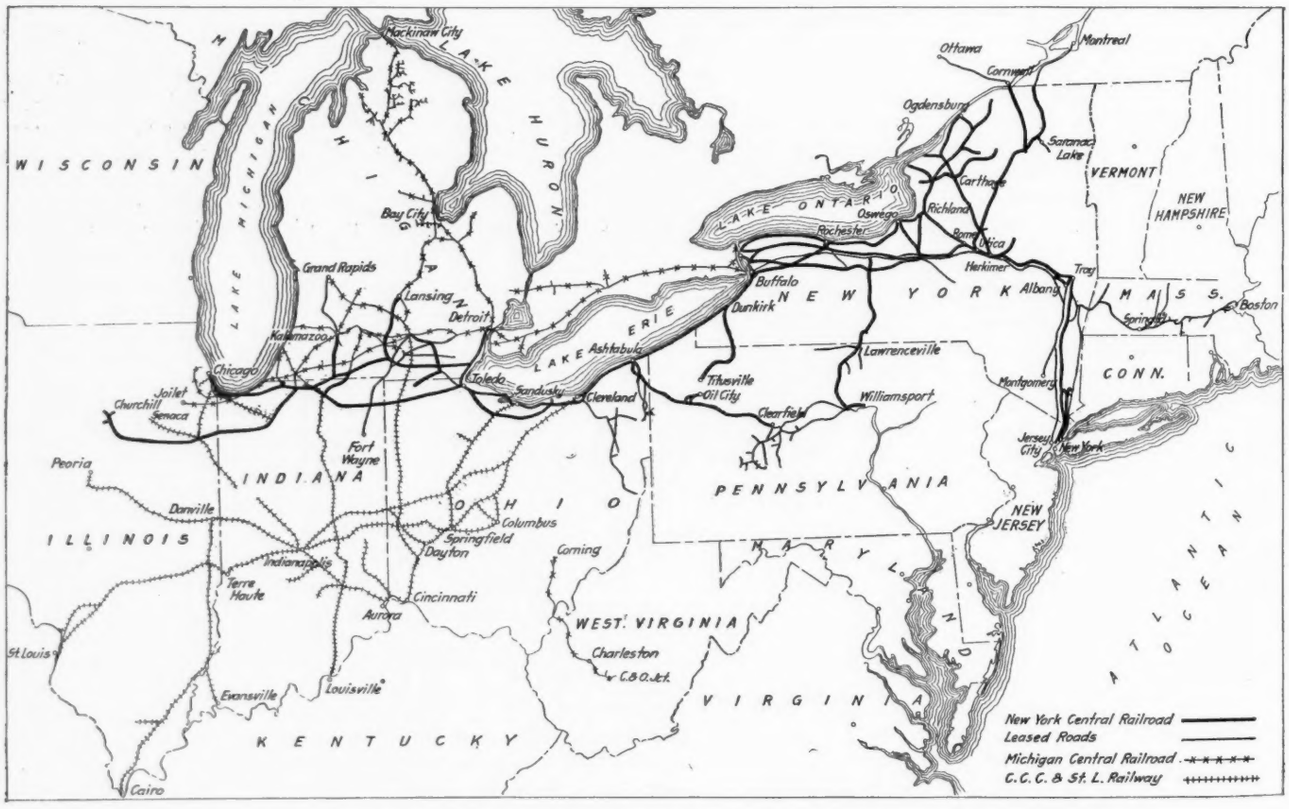
Again we find in the opinion of the court this statement:

> The act by its terms expresses with sufficient certainty the intention of Congress that hand brakes shall not be used on freight trains in the ordinary movement of such trains in interstate commerce.

What is meant by "the ordinary movement of such trains in interstate commerce?" Is not operation on mountain grades abnormal, and should it not be considered as other than ordinary movement? On level roads gravity tends to assist the brakes in stopping trains, but on grades gravity works against the brakes. The efficiency of the air brake cannot be questioned, but in the interests of safety to the trainmen, it is not advisable to rely upon it entirely in operating on mountain grades, even though the brakes be in 100 per cent operating condition. The sudden failure of the air pump, error on the part of the engineer in handling the brakes, or a number of other factors which depend upon the human element or are beyond human control, may prevent the most efficient operation of the brakes and result in serious accident unless they are supplemented by the use of hand brakes. In operating on such grades brakemen should be so stationed on the train that in case of emergency they may be called upon to operate the hand brakes. On the other hand, the railroads cannot be excused from seeing to it that the brakes are maintained in the very best possible condition and that so far as it is humanly possible, such trains be braked 100 per cent. In the interest of both safety to life and protection to property operation over mountain grades should be construed as abnormal; the act is so worded that it was undoubtedly the intent to allow the use of the hand brakes, as far as it might be necessary, in such cases.

NEW YORK CENTRAL

THE operating department is lifting the New York Central out of what appeareed to be the unsatisfactory financial condition of the company two to three years ago. The earnings from the 5,640 miles of railroad which is now operated by the New York Central Railroad Company were $15,561,000 greater in the calendar year 1915 than in 1914.



The New York Central, the Cleveland, Cincinnati, Chicago & St. Louis and the Michigan Central

There was a saving of nearly $4,000,000 in expenses, so that railway operating income in 1915 amounted to $50,179,000, or $19,264,000 more than the 1914 operating income. Three-quarters of the saving which was made in expenses was in transportation expenses and the keynote of this saving was an increase of over 100 tons in the aver-

age trainload and a proportionate decrease in fuel costs. The 1915 increase in trainload followed an increase of 8 tons in 1914 over 1913 on the Lake Shore, and 28 tons on the New York Central & Hudson River—these are the two companies which were consolidated in December, 1914, together with some smaller companies to form the New York Central Railroad. In 1914 as compared with 1913 there were large reductions made in transportation expenses with only a slight increase per revenue train-mile run. The New York Central has reversed the usual method of attack on transportation expenses which generally consists of an increase in trainload accompanied by at least proportionate increased expense per train-mile, and then a gradual reduction in the abnormal train-mile expenses, and began by holding down expenses per train-mile and then increasing its trainload without proportionately running up these train-mile expenses.

About eighteen months ago the management began running a dynamometer car over each division of the entire system. The rating of all of the engines on every one of the divisions was readjusted to correspond with the showing made by the dynamometer car tests. Machines for equating tonnage were installed in every yard of any size on the system. Partly as a consequence of these steps and partly as a consequence of the interest which was aroused in the operating officers, remarkable gains were made in loading drag freight trains on main line. There were about 200 heavy freight locomotives added in the latter part of 1914 and early part of 1915 and this power was put into service on the main line. During the last two years a considerable percentage of the locomotives owned by the road has been equipped with superheaters. The results speak for themselves.

The new company—the New York Central Railroad Company—is a consolidation of the New York Central & Hudson River, the Lake Shore & Michigan Southern, the Geneva, Corning & Southern, the Terminal Railway of Buffalo, the Dunkirk, Allegheny Valley & Pittsburgh, the Chicago, Indiana & Southern, the Detroit & Chicago, the Detroit, Monroe & Toledo, the Kalamazoo & White Pigeon, the Northern Central Michigan, and the Swan Creek Railway. The total mileage operated is 5,640. The total mileage owned is 3,699, and, in addition, there is 1,414 miles operated under lease, 60 miles operated under contract, and 467 miles operated under trackage rights. In 1914 the Lake Shore had $11,421,000 operating income and the New York Central & Hudson River, $22.543,000. After the payment of 12 per cent dividends on its common stock, the greater part of which went to the New York Central & Hudson River, the Lake Shore had a surplus of $1,125,000, and after the payment of 5 per cent on its outstanding stock in the hands of the public the New York Central had a deficit in 1914 of approximately $3,000,000. In 1915, after the payment of 5 per cent dividens on its outstanding stock, the New York Central Railroad Company had a surplus to carry to profit and loss of $15,245,000, and it needed a surplus such as this to help put it back into a more sound position. Against this credit of $15,245,000 there had to be charged off the $3,000,000 declared in dividends in 1914 in excess of earnings available for dividends in that year; $1,442,000 for depreciation accrued prior to July 1, 1907, on equipment retired during 1915, and the management considered it proper to also appropriate from surplus $1,139,000 for depreciation reserve.* In 1915 there was $195,000 charged to income for amortization of discount on funded debt and there was carried over as an unadjusted debt on the balance sheet $6,909,000 discount on funded debt unamortized. As of December 31, 1914, the New York Central had $60,510,000 loans and bills payable, and the Lake Shore & Michigan Southern, $52,805,000. The total cash for the two companies was approximately $22,600,000. In May, 1915, the new company sold $100,000,000 20-year 6 per cent convertible debenture bonds. On December 31, 1915, loans and bills payable of the new company amounted to $22,020,000, and there was $33,810,000 cash on hand.

*This is in addition to the depreciation charged under maintenance of equipment to 1915 expenses.

The plan of consolidation of the Lake Shore and the New York Central & Hudson River provided for the exchange of Lake Shore collateral 3½ per cent bonds for New York Central & Hudson River consolidation mortgage, series A, 4 per cent bonds. Of the $90,578,000 outstanding 3½ per cent collaterals about two-thirds had, up to December 31, been deposited for exchange into 4 per cent bonds and the difference in interest rate on the bonds deposited had been charged to the new company's 1915 income account. There were $3,059,000 spent for additions and betterments to the property owned and $2,322,000 for additions and betterments to leased property and a net increase in investment in equipment of $200,000. Work was almost entirely suspended on the New Grand Central Terminal awaiting improvement in the financial condition of the company which will permit it to obtain money for the completion of this terminal at a reasonable rate of interest.

In 1915 the New York Central Railroad Company earned a substantial amount, more than twice its dividend requirements. This permitted it to put into the property as additional investment almost a dollar for every dollar paid out in dividends, even after clearing up the last quarterly dividend which was not earned in 1914. Unless labor troubles or some unforeseen event interferes, the first half, at least, of 1916 ought to be as far ahead of the first half of 1915 as the last half of 1915 was ahead of the last half of 1914. It is unlikely that there will be as very large grain crops in 1916 as in 1915. It would appear that the chances for this calendar year were as good as for the previous year. If the company were to pursue the conservative policy of maintaining the 5 per cent dividends and can earn a surplus of ten to fifteen million dollars above its dividend requirements in 1916, it will go far to re-establish the credit which rightfully belongs to one of the greatest trunk lines in the world.

The following table shows the principal figures for operation in 1915 as compared with 1914:

	1915.	1914.
Mileage operated	5,640	5,640
Freight revenue	$104,278,092	$90,082,476
Passenger revenue	40,107,753	40,411,080
Total operating revenues	167,912,333	152,351,590
Maint. of way and structures	17,133,450	18,031,213
Maintenance of equipment	31,628,858	31,552,301
Traffic expenses	2,645,373	2,707,833
Transportation expenses	51,879,176	54,781,675
Miscellaneous expenses	2,237,724	2,350,733
General expenses	3,869,764	3,924,667
Total operating expenses	109,394,345	113,348,423
Taxes	8,324,326	8,080,811
Operating income	50,180,458	30,929,068
Gross income	66,809,329	45,664,933
Net income	27,711,474	9,358,248
Dividends	12,466,484	11,574,613*
Surplus	15,244,990	.....†

*Dividends paid by N. Y. C. & H. R. only.
†Deficit is not estimated because the comparison would not be accurate.

Percentage of each class of expenses to total operating revenues:

	1915	1914
Maintenance of way and structures	10.20	11.83
Maintenance of equipment	18.84	20.71
Traffic expenses	1.58	1.78
Transportation expenses	30.90	35.96
Miscellaneous expenses	1.33	1.54
General expenses	2.30	2.58
Total	65.15	74.40

MICHIGAN CENTRAL

THE Michigan Central, like the other New York Central lines, showed improvement in freight earnings and, unlike the parent company or the Cleveland, Cincinnati, Chicago & St. Louis, it showed also increases in passenger revenue. Like the other two companies it made a notable saving in transportation expenses, but in part in the case of the Michigan Central this was offset by larger outlays for maintenance. The final result was a surplus, after the payment of the regular 4 per cent dividends, of $2,064,000 in 1915, comparing with a deficit, after the payment of the 4 per cent dividends, of $335,000 in 1914. In addition to the 4 per cent dividends there was an additional dividend of 1 per cent declared out of surplus in 1915 calling for $187,000.

The Michigan Central operates 1,803 miles of road; of this but 270 is owned and 1,429 is leased, the remainder being proprietary lines 8 miles and trackage rights 96 miles. The total tonnage of revenue freight carried in 1915 amounted to 20,103,000, an increase over the previous year of 907,000 tons. The average length of haul in 1915 was 157 miles and in 1914 160 miles; thus the freight density (ton miles per mile of road) in 1915 was 1,771,000, and in 1914 1,729,000. Average receipts per ton per mile in 1915 were 7.33 mills, and in 1914 6.75 mills. The very considerable increase is in part due to the Interstate Commerce Commission's allowance of the 5 per cent rate advance and in part to a difference in proportion of various commodities carried.

The number of passengers carried amounted to 5,721,000, a decrease of 349,000, and the average length of journey was 74.3 miles in 1915 and 71.6 miles in 1914. The passenger density was 248,000 in 1915 and 252,000 in 1914. The average receipts per passenger per mile were 2.208 cents in 1915 and 2.042 cents in 1914.

With total operating revenues amounting to $36,541,000, or $3,076,000 more than in 1914, total operating expenses amounted to $25,727,000, an increase of $546,000. Transportation expenses amounted to $13,396,000, a saving of $775,000. The two largest items of saving were in fuel for train locomotives, which cost $2,188,000 in 1915, or $250,000 less than in 1914, and in payments for loss and damage to freight, which payments amounted to $472,000 in 1915, or $175,000 less than the payments in 1914. The president in his report specifically mentions the superheater as one of the factors in increased trainload and decrease in fuel consumption. The other factors he mentions in this connection are the use of larger locomotives on the main line and on the Mackinaw division, and a closer supervision over yard operation expenses. The average trainload of revenue freight in 1915 was 506 tons, an increase over 1914 of 44 tons. The average number of freight cars per train-mile was 45 in 1915 as against 42 in 1914, and the average number of loaded cars per train, 30 as against 28. The average number of tons per loaded car-mile was 16.88 in 1915 and 16.67 in 1914. It may have been significant that there were 276,751,000 freight train car miles in 1915, or 2,283,000 less than in 1914. The decrease was the result of an increase of 1,158,000 loaded freight car miles, and a decrease of 2,985,000 empty freight car miles and a decrease of 456,000 caboose car miles.

The saving made in transportation expenses was more than offset by the heavier expenditures for maintenance. Maintenance of way cost $4,533,000 in 1915, or $905,000 more than in the previous year, a considerable part of this increased expenditure being due to the very much heavier tie renewals. Ties used in renewals in 1915 cost $1,187,000, or $497,000 more than in 1914, due presumably to a larger number of tie renewals, no mention being made of any large increase in the cost per tie. Track laying and surfacing, which is a labor outlay proportionate to the amount of tie or rail renewal work done or of ballasting, cost $1,225,000 in 1915, or $216,000 more than in 1914.

In 1915 $5,765,000 was spent for maintenance of equipment, an increase of $416,000 over the expenditures in 1914, accounted for almost entirely by $356,000 more spent for freight car repairs and $121,000 more for locomotive repairs, the total for freight cars in 1915 being $1,188,000, and for locomotives $1,703,000.

The following table shows the principal figures for operation in 1915 as compared with 1914:

	1915	1914
Mileage operated	1,803	1,800
Freight revenue	$23,050,122	$20,717,272
Passenger revenue	9,386,421	8,880,613
Total operating revenues	36,540,665	33,464,968
Maint. of way and structures	4,533,241	3,628,376
Maintenance of equipment	5,764,870	5,349,079
Traffic expenses	721,913	762,657
Transportation expenses	13,395,872	14,170,444
Miscellaneous expenses	569,133	582,480
General expenses	742,458	687,447
Total operating expenses	25,727,487	25,181,484
Taxes	1,522,936	1,598,350
Operating income	9,285,601	6,681,796
Gross income	10,214,084	7,608,158
Net income	2,926,957	414,419
Dividends	936,900	749,520
Appropriations for additions and betterments	113,176	.....
Surplus	1,876,881	335,101*

*Deficit.

THE BIG FOUR AND THE PAN HANDLE

THE Cleveland, Cincinnati, Chicago & St. Louis has apparently pretty well gotten over the after effects of the disastrous flooods of 1913. In 1914 there were very heavy expenditures made for replacement of damaged railroad property and these expenditures had to be charged in whole or in part to maintenance expenses. In addition to this increase in expenses the actual transporation expenses were abnormally high because of the lack of the facilities which were being rebuilt. In the calendar year ended December 31, 1915, the road earned $38,364,000, or $2,998,000 more than in 1914, with operating expenses of $27,528,000, or $1,427,000 less than in 1915. The result was a gain of $4,425,000 in net revenue—a decrease from 81.87 per cent. operating ratio in 1914 to 71.76 per cent operating ratio in 1915—and a final credit to profit and loss, after the payment of interest charges, of $3,321,000 in 1915, comparing with a debit to profit and loss in 1914 of $1,974,000. The smaller extraordinary expenditures for maintenance helped to a certain extent, but much the larger saving was made in transportation expenses. These expenses in 1915 amounted to $13,710,000, or $872,000 less than in 1914. Passenger business was less than one per cent less than in 1914, while the ton mileage of revenue freight was about 8 per cent. more; thus, almost the same passenger business and 8 per cent greater freight business was handled at an out of pocket cost of 6 per cent less. There was a large saving made in the cost of fuel for train locomotives. This cost in 1915 was $1,859,000, or $197,000 less than in 1914. Probably even more illustrative, as showing how the saving was made in transportation expenses, was a reduction of from $71,000 to $46,000 in supplies other than fuel and lubricants for train locomotives; a reduction from $511,000 to $473,000 in enginehouse expenses; a reduction from $444,000 to $412,000 in train supplies and expenses. Reductions such as these are indications of better supervision. There was also a very large reduction in the payments for loss and damage to freight. These payments amounted to $711,000 in 1914 and to but $480,000 in 1915. This is a reduction of $231,000.

In making general comparisons of the two great trunk line systems—the Pennsylvania and the New York Central—it is often said rather loosely that the Panhandle of the Pennsylvania system corresponds to the Big Four of the New York Central system. While it is true that these two roads are competitive on certain classes of business and in some ways the functions which each perform in connection with

its parent system are comparable, there are some striking differences between the two roads which, by reflection in traffic and earning statistics, make clear some of the principles on which railroad earning power is founded.

The Cleveland, Cincinnati, Chicago & St. Louis (the Big Four is shown on the accompanying map by a hatched line; the Pittsburgh, Cincinnati, Chicago & St. Louis (the Pan Handle is what is called the southwest system of the Pennsylvania Lines West. Its main line runs from Pittsburgh west to Columbus, Ohio, where it divides, one main line running northwest to Chicago through Logansport, Ind., and the other running to Cincinnati and to Indianapolis, where it connects with the Vandalia, another Pennsylvania line running to St. Louis. There is a line running south from Indianapolis to Louisville.

The Big Four operates 2,385 miles; the Pan Handle 1,489 miles. The Big Four is a network of lines; the Pan Handle a main line with branches. The funded debt of the two companies averages much the same per mile of line—approximately $42,000 for the Big Four and $41,000 for the Pan Handle. On the other hand, the Pan Handle, with a much smaller mileage, has $67,609,000 stock, whereas the Big Four has $57,056,000 stock. The Big Four paid no dividends on preferred common stock in either 1915 or 1914 and had a deficit of $1,974,000, after the payment of interest charges, in 1914, and a surplus of $3,321,000, after the payment of interest charges, in 1915. The Pan Handle paid 4 per cent on its preferred stock and three-fourths of one per cent on its common stock in 1914 and had a few thousand dollars surplus, and paid 4 per cent on its preferred stock and 2 per cent on its common in 1915 and had $1,836,000 surplus.

Among the more important points of similarity between the Big Four and the Pan Handle are: each is the road over which the system's business between the St. Louis gateway and the Atlantic seaboard passes, as does also the business from the Great Lakes for Cincinnati, Indianapolis and St. Louis; each has a line from Chicago to Cincinnati; each has had its rates fixed at the present level on a large proportion of the freight traffic by the keen competition in Central Freight Association territory. The fact that the Pan Handle serves the Pittsburgh district is an important factor in determining averages with which there is no corresponding factor for the Big Four.

The per cent of total revenue furnished by freight on the Big Four is 69.10, and on the Pan Handle 69.16. The ton-miles of revenue freight carried one mile per mile of road on the Big Four in 1915 was 2,011,000, an increase as compared with the previous year of 141,000, and on the Pan Handle, 3,083,000, an increase as compared with the previous year of 240,000. The average length of haul on the Big Four was 173 miles in 1915, an increase of 4 miles over the previous year; and on the Pan Handle, 120 miles, an increase of 5 miles.

Of the total 27,484,000 tons of freight carried by the Big Four in 1915, 56 per cent was furnished by products of mines. Of the total 38,254,000 tons of freight carried by the Pan Handle, 54 per cent was products of mines. Manufactures furnished 21 per cent of the Big Four's tonnage and 20 per cent of the Pan Handle's; agricultural products furnished 11 per cent of the Big Four's tonnage and 8 per cent of the Pan Handle's; lumber furnished 7 per cent of the Big Four's tonnage and 5 per cent of the Pan Handle's. The Big Four's figures and percentages include the distributed proportion of l. c. l. freight to each class; the Pan Handle's do not, and of the total Pan Handle tonnage 7 per cent was l. c. l. tonnage undistributed.

The average trainload of revenue freight on the Big Four in 1915 was 589 tons, an increase of 41 tons over 1914. The average trainload of revenue freight on the Pan Handle in 1915 was 543 tons, an increase over the previous year of 48 tons. The average receipts per ton per mile on the Big Four was 5.57 mills, an increase of 0.26 mills, and on the Pan Handle, 6.24 mills, a decrease of 0.05 mills. The number of passengers carried one mile per mile of road on the Big Four was 179,000, and on the Pan Handle, 271,000. The average receipts per passenger per mile were 2.001 cents on the Big Four, and 2.036 cents on the Pan Handle. The average passenger journey on the Big Four was 52 miles, and on the Pan Handle, 37 miles.

Had the Big Four received the same average rate per ton per mile as the Pan Handle, all other conditions remaining the same, the company would have earned a surplus of $6,612,406 in 1915, equivalent to 4 per cent on its preferred stock and over 13 per cent on its common stock, comparing with the 4 per cent paid on the Pan Handle's preferred stock and about 7 per cent earned on its common in 1915.

The following table shows the principal figures for operation for the two roads in 1915 and 1914.

	Big Four*		Pan Handle†	
	1915	1914	1915	1914
Mileage operated	2,385	2,381	1,489	1,472
Freight revenue	$26,510,832	$23,436,211	$28,665,485	$26,361,971
Passenger revenue	8,514,689	8,589,012	8,214,579	8,203,173
Total operating revenues	38,364,087	35,365,691	41,445,690	39,139,400
Maint., way and structures	4,417,348	4,740,009	5,791,544	5,215,069
Maint. of equipment	7,487,072	7,713,041	7,853,380	7,699,967
Traffic expenses	876,499	892,604	766,485	801,246
Transportation expenses	13,709,987	14,582,391	14,532,833	14,927,438
Miscellaneous expenses	286,987	301,396	300,108	317,110
General expenses	849,225	753,278	1,023,281	1,049,764
Total operating expenses	27,528,367	28,954,969	30,267,633	30,010,597
Taxes	1,514,131	1,526,715	1,927,159	1,916,796
Operating income	9,314,103	4,878,730	9,246,126	7,210,547
Gross income	10,448,939	5,811,928	9,981,718	7,875,061
Net income	3,404,731	1,960,418‡	4,725,922	2,314,097
Dividends	.....	.....	1,948,556	1,378,244
Applied to sinking fund	.....	.....	941,130	880,520
Surplus	.....	.....	1,836,236	55,332

*Cleveland, Cincinnati, Chicago & St. Louis.
†Pittsburgh, Cincinnati, Chicago & St. Louis.
‡Deficit.

NEW BOOKS

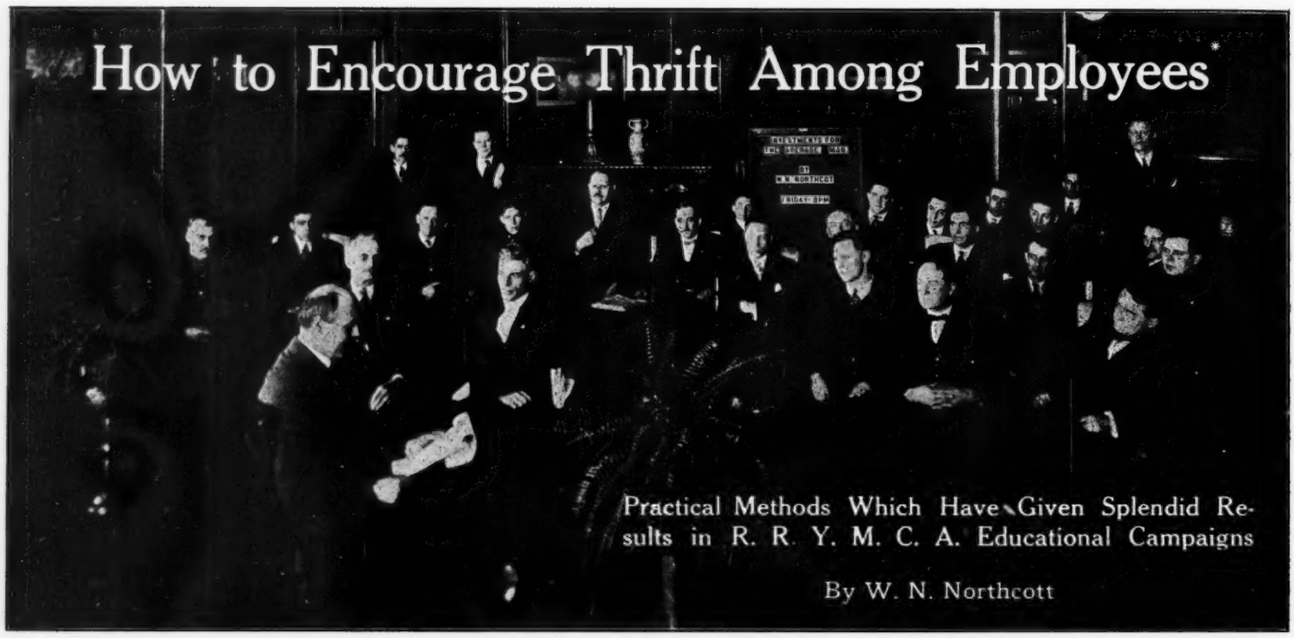
Statistics of Common Carriers, 1915; Preliminary Abstract. Interstate Commerce Commission, Washington, D. C. 230 pages, 9¼ in. by 11½ in. Paper covered. To be had from the Superintendent of Documents, Government Printing Office, Washington, at 35 cents a copy.

This is the regular preliminary issue, the fifth annual number, showing revenues and expenses in detail, income statements, operating statistics, etc., for each of the railways in the country having annual operating revenues above $1,000,000. Three pages are devoted to abstracts from the annual reports of the principal express companies and from that of the Pullman Company. The statement of the aggregates of statistics for the whole country for the year ending June 30, 1915, has not yet appeared.

Principles of Locomotive Operation and Train Control.—By Arthur J. Wood, M.E., assistant professor in charge of railroad mechanical engineering, Pennsylvania State College. Bound in cloth. 264 pages, 6 in. by 9 in. Illustrated. Published by the McGraw-Hill Book Company, Inc., 239 West 39th street, New York.

The absence of a text book presenting the recent developments in locomotive performance and including a study on air brakes led the author to prepare this work, which is intended as an elementary treatise for use in technical schools. At the same time the engineer may review in it the theories on which are based certain problems in design and construction. The author has endeavored to present the principles, beyond which lies the field for extended study. The book takes up tractive effort, the acceleration of trains and train resistance, and there is a chapter devoted to new graphical methods applied to locomotive performance as well as one on dynamometer car tests and tonnage rating. Another chapter is devoted to air brakes, while considerable space is also devoted to combustion and fuel economy; the formation and action of steam; theory and practice as regards superheated steam; locomotive ratios; testing, and counterbalancing. Chapters are aso given to the electrification of steam railways and materials of construction, while an appendix contains a number of valuable tables.

How to Encourage Thrift Among Employees



Practical Methods Which Have Given Splendid Results in R. R. Y. M. C. A. Educational Campaigns

By W. N. Northcott

Thrift Meeting Held in Dearborn Station Y. M. C. A., Chicago, Friday Evening, March 31.

LET us first define, in terms of our work, the meaning of the often used, and sometimes misused, word, thrift. Two definitions are commonly used today. One was given by John Wesley, and is: "Make all you can, save all you can, give all you can." Another, which perhaps is nearly as good, is: "Make all you can, spend carefully, save and invest wisely." The old time idea of a thrifty man was too narrow and selfish, for in our boyhood days a man was counted thrifty who had saved, even though he were miserly! We can conceive now of a man being thrifty who has a comfortable income, and who at the end of the year might not be able to point to a large percentage of his money in a savings account, but who during that time may have invested his savings in the education of his children, or himself, which in time would yield good returns, financial and otherwise.

There is a locomotive shop in the middle west employing nearly 3,000 men. The Young Men's Christian Association has operated in that community and ministered to these men for nearly 20 years. At a time when the association was doing its largest work, and reaching the greatest number of men, the maximum number thus reached did not exceed 800, which meant that seemingly the association had no message for 2,200. To admit that we could not reach these men, and that they were indifferent, meant to excuse our short-sightedness and at once consider that the Young Men's Christian Association was meant only for a chosen few. We are convinced that if men cannot be reached one way, in the providence of God and the wisdom of men there are other ways to reach them. The discussion of thrift in the modern acceptation of its definition has almost a universal message, and should and will establish a point of contact, with men who cannot be reached by the ordinary type of gospel or educational meeting.

Thrift and Religion

Dr. D. G. Latshaw, while a pastor in Dayton, Ohio, called on a family which had recently been admitted to his church. They were of the rougher type and had been careless as to personal and family finance previous to becoming Christians. Although he was in the home for only half an hour the daughter was sent to answer the door bell three times, and each time was instructed to tell the party at the door to call again next Tuesday. Dr. Latshaw had called to talk over spiritual matters. Suddenly he asked the mother if he could see her and her husband if he called after supper. She said he could. The Doctor hurried downtown to see one of the church officers who was a good business man. He told of his visit and said it was a time to talk family expenses as well as family religion. Said he to the business man, "Will you take this family and its financial problems and stay by till they are ready to stand alone. I'm convinced that unless you do, it is only a short while till they will be on the rocks spiritually." The business man accepted the charge, and the family the co-operation. At last reports, after nine years, the family is still in the church. They have moved to a better neighborhood and have saved their self-respect, as well as their souls.

The time was that we evidenced our interest in needy men through benefits, subscriptions, collections, etc., and it served its purpose, but we should now do more than that. In fact, we should do that which will make such means as we have just described less necessary. We must do a permanent constructive piece of work, and in so doing will attract and hold the attention and confidence of men who today are saying through prejudice or other cause, that the religionist is not a practical person.

Permanency should be one of our principal goals. Much harm will come if hasty and temporary plans only are employed. We have seen campaigns of this and other sorts that have been put on because it seemed the prudent thing to do, and might win for the association considerable publicity, and perchance convince the railroad corporations, the brotherhoods and others of its zeal in welfare work. This only burns a good field over, and sometimes prevents doing real genuine and permanent service to the men. Statistics should not be our goal. We should be satisfied (if that were the best we could do) if we could take five men in one year, stimulate them, and guide them in matters of thrift so that when we left them they would not fall into their former practices, but would become disciples—teachers—of the propaganda.

Not long since, while speaking at a gospel meeting in a railroad shop, a bright, sober-minded, clear-headed fellow said to us at the close of the meeting: "Why don't you say these things to the big men downtown? We don't need to hear so much of the gospel story and its message as the man

*Adapted from an address before a conference of Pennsylvania Railroad Y. M. C. A. secretaries at Derry, Pa. Mr. Northcott, who is the originator of the thrift campaign idea in Railroad Y. M. C. A. circles, is Metropolitan Railroad Y. M. C. A. secretary at Chicago.

downtown who holds the bag needs it. Have him loosen those strings. What we need is not more religion, but more money." He was truly sincere and we sympathized with him; but after further talk he was convinced that while he might, and perhaps did, need a larger income, he no less needed to know better how to use what money he did receive. He represents a type of man earning nearly $100 per month, who has never carefully studied his own financial problem; as increases have come, expenses have also increased, and there has come no permanent help to him financially because of increase in pay.

Advertising the Thrift Campaign at Bradford, Ohio

The railroad corporations today are studying the matter of income and expense as never in their history. Not with the idea alone of increasing their income, but rather of decreasing the outgo. Today because of state and inter-state legislation, the increased demands of labor and the high cost of materials, great corporations, especially railroads, have been forced carefully to consider thrift in all its aspects. When Louis Brandeis said several years ago that the railroads were wasting $1,000,000 a day, thousands of people laughed, but students took notice, and the result is that there is movement in the direction of thrift that the American nation has never witnessed before. Five years ago "safety first" and "efficiency" were two words on the lips of nearly every one. If time would permit we could cite instances of how "safety first" can be, and is, coupled with the thrift propaganda.

What is our thrift message? We are not here to advocate one type only but to inform you of the many messages from very fertile brains which are at your command. Clyde A. Mann, editor of "Opportunity and Ways of Thrift," at Geneva, Ill., is publishing a monthly magazine devoted entirely to this great idea, and incidentally developing a league for thrift, to be organized in great corporations and on railroad systems. The American Society for Savings and Thrift, with headquarters in New York and Chicago, is constantly sending out bulletins brimful of suggestions that may easily be adapted to your work. Any one who wants this information needs only to make his wants known by addressing the bureau at 5 Nassau street, New York. The Industrial Department of the International Committee of the Y. M. C. A. has a set of slides and pictorial cartoon charts which can be had by arranging with the committee and at a very nominal cost. These have often been used to great advantage.

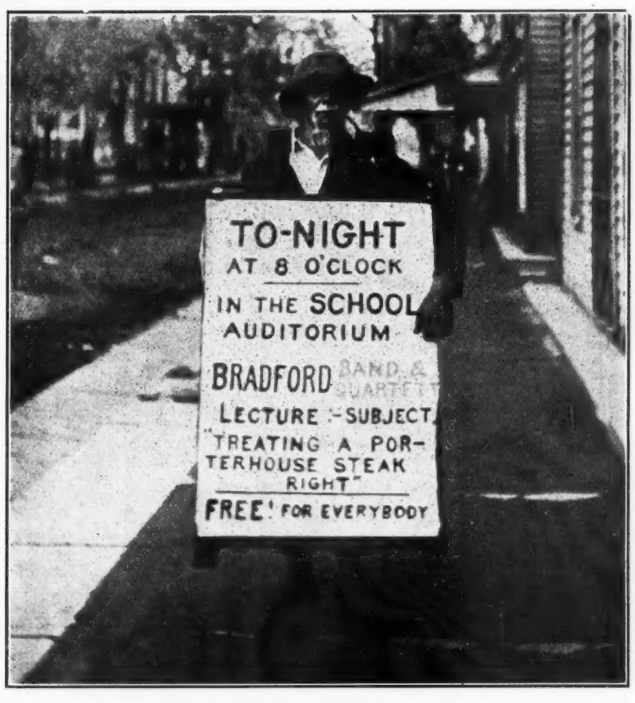
Lectures on Thrift

The Chicago Y. M. C. A. has published a set of six lectures on thrift, turning them over to the railroad department of the International Committee. These are the outgrowth of long and varied contact with the wage earner and his problems. The first one was written by John Oskinson, associate editor of Collier's Magazine, a daily correspondent on thrift for Chicago and New York dailies. His subject is: "The Reasons for and Possibilities of a Life of Thrift," so written as to interest the wage earner, and at least prove to him that it is worth trying.

The second one, written by John H. Ihlder, field secretary of the National Housing Association, New York, is on: "Where to Live—Housing and Health." It is calculated to answer one of the first questions that come up in a married man's life in considering thrift. The language and the thought are simple and direct, and leave a man feeling comfortable, yet inspired.

The third one, written by W. H. Ball, physical secretary of the International Committee, is on: "Amusements and Recreation." It shows the place of good health in the problem of earning, also the need of play life, even for the grown up, and its relation to the problem of thrift.

The fourth was written by Mr. Oskinson and is on "Household Accounting—Keeping Track of What Comes In and Goes Out." In this connection the forms shown in the illustration may be used in helping to keep track of these very important items.



Thrift Campaign Advertising Poster, Bradford, Ohio

Now that we have led to keeping track of the money, it is highly important that if the men have savings, they should know something about investments, so the fifth lecture was written by William T. Bacon, vice-president of the Chicago Savings and Trust Company, on: "Investments for the Average Man." Very candidly and helpfully bonds and stocks are discussed, showing the difference, and explaining how even men with small savings can find a safe place for investment, proving at once that a poor man has access to

certain kinds of investments and savings that are commonly thought to be only open to men of large wealth.

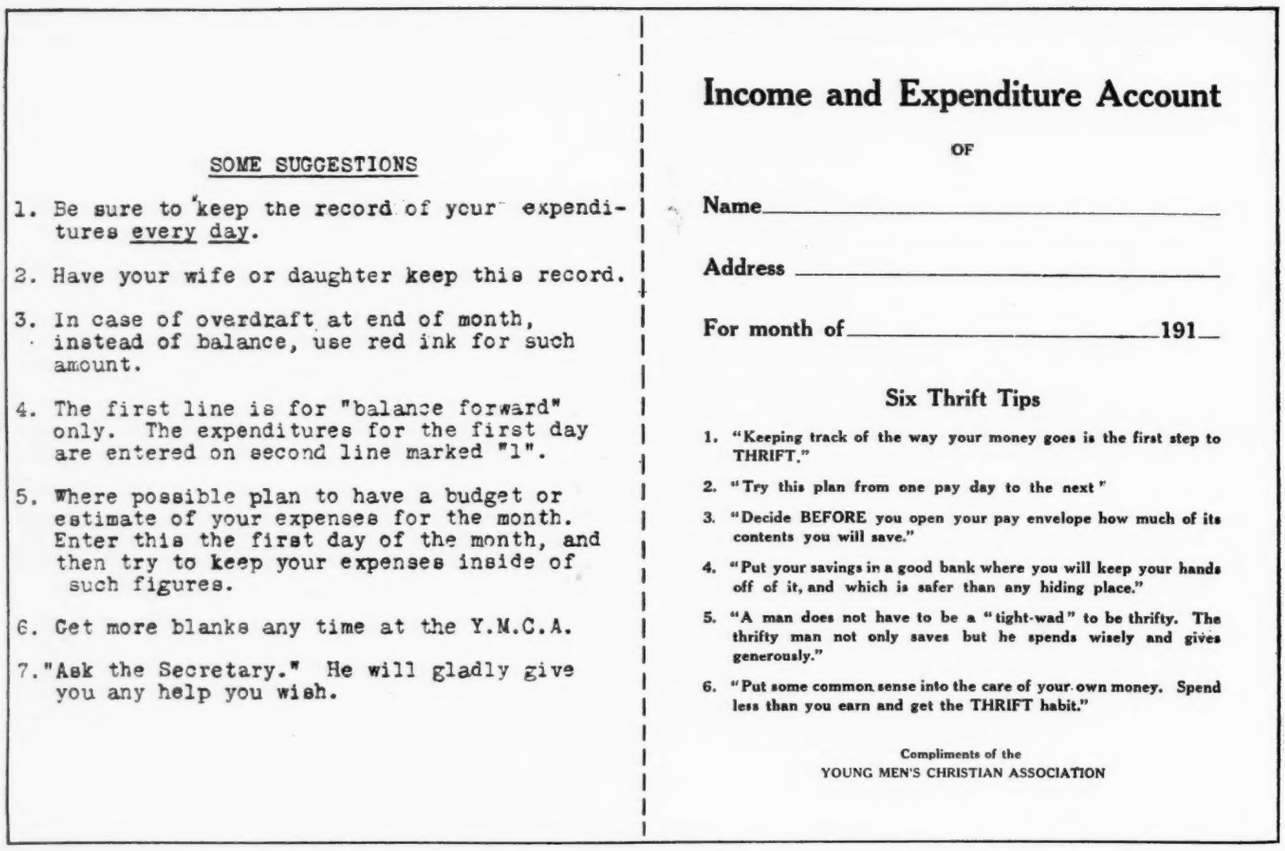
The sixth, seventh, eighth and ninth are suggestive lectures on methods. The sixth one written by Mr. Calhoun of the Leonard Seed Company is on: "The Working Man's Garden, His Gold Mine," and certainly needs no explanation. The seventh and eighth are to be written by government experts on "Food Costs and Food Values," and "Clothing Costs and Clothing Values." The ninth, which closes the series, is to be written by some one yet to be chosen, on "The Housekeeper and the Problem of Thrift."

Detail Plans for Thrift Campaign

There are many ways of conducting a campaign for thrift. After carefully studying conditions, select a committee of representative men who will help organize and promote a thrift propaganda. Do not omit the school authorities from your committee. If you are in a community which is not too large, where the association has a point of contact and is held in high esteem, then a community-wide campaign, using the exhibits mentioned above, having big platform meetings, bringing in outside speakers and thus doing everything you can to start the people thinking on this subject, is highly advantageous; provided, however, you have a sincere plan which is feasible, and have good backing from reliable people that will make it possible for you to really teach thrift. The community-wide program is a fine stimulant, but it is not a body builder. Thrift cannot be taught over night. It takes patience—line upon line, precept upon precept—to make it effective.

In railroad shops we would recommend the consideration of two plans. The first is more ideal than the second. First, arrange with the authorities where the meetings are to be held, fully and accurately describing the plan and the purpose. Also explain to the men that you are not to discuss the question of wages, but rather how to make what they earn go farther. Pick out a group of interested men, and give a careful summary of the first lecture above noted to them. Avoid discussing topics that will be considered later on. Put in local color for striking illustrations, and then let a whole week pass before the second lecture is taken up. However, arrange to spend one or two noons during the week with men in this group, handing them literature on the subject, but do not flood them with it. Be sure to get the names of all men present at the meetings and try to keep them consistent in their attendance, not making any efforts to attract others to this particular series. It is best to have every man hear every lecture. At the close of Lecture 4, organize the men who will agree to keep an accurate and honest account of their income and expense for one month, making sure that if it is to be a household matter every member of the household is to co-operate. More than one man has been defeated in his good intentions because there has been no co-operation from the housewife, or the children. Better not have him undertake it hastily, than have him rush into it and repent because there has been no co-operation. At the end of the fifth lecture, arrange for evenings where lectures six, seven, eight and nine can be given at some convenient place and invite the men to bring their families. Have them make a social affair of it. You may find the women folks will be somewhat suspicious of your good intentions, and you must break down their prejudices frankly, yet kindly. You cannot succeed with this program without their co-operation.

The second plan is somewhat similar to the first, except that anyone will be allowed to come and go as he wills, and the lectures should follow day after day under outside prominent leadership with the hope that at the end of a series of five, you can gather in a group of men who will form a club



SOME SUGGESTIONS

1. Be sure to keep the record of your expenditures every day.
2. Have your wife or daughter keep this record.
3. In case of overdraft at end of month, instead of balance, use red ink for such amount.
4. The first line is for "balance forward" only. The expenditures for the first day are entered on second line marked "1".
5. Where possible plan to have a budget or estimate of your expenses for the month. Enter this the first day of the month, and then try to keep your expenses inside of such figures.
6. Get more blanks any time at the Y.M.C.A.
7. "Ask the Secretary." He will gladly give you any help you wish.

Income and Expenditure Account

OF

Name_____

Address _____

For month of_____**191**__

Six Thrift Tips

1. "Keeping track of the way your money goes is the first step to THRIFT."
2. "Try this plan from one pay day to the next"
3. "Decide BEFORE you open your pay envelope how much of its contents you will save."
4. "Put your savings in a good bank where you will keep your hands off of it, and which is safer than any hiding place."
5. "A man does not have to be a "tight-wad" to be thrifty. The thrifty man not only saves but he spends wisely and gives generously."
6. "Put some common sense into the care of your own money. Spend less than you earn and get the THRIFT habit."

Compliments of the
YOUNG MEN'S CHRISTIAN ASSOCIATION

Outside Pages of Form for Monthly Record of Income and Expenditures

The second plan is somewhat similar to the first, except that anyone will be allowed to come and go as he wills, and the lectures should follow day after day under outside prominent leadership with the hope that at the end of a series of five, you can gather in a group of men who will form a club

to use the forms and keep the accounts on a 30 days' trial. The club should not be too large. It would be splendid if an Association could have three, four or five clubs of 10 or 15 men each, rather than have one club of 50 or 75. The spirit of friendly rivalry will go a long way toward keeping the clubs alive. (Be careful of the man who has a great story to tell of his own thrift. Before you allow some man to exploit himself on his fellows, privately hear his story and confirm as many of the details as you can for there will be somebody in the crowd who will know if he tells an untruth, and that will spoil much favorable influence that you would otherwise be able to create. Too much publicity of individual accomplishments through the press or on the platform creates jealousy and sometimes hinders.) Better 25 men actually doing it, than 250 starting to, and going only a short way. Permanency should be the keynote of the work.

A third plan for use in the Association building, and by all odds the most feasible and attractive, is to take groups of men in the lobby, who are naturally congenial, picking out the man who is a leader of a given group and having him read Lecture 1 and so on throughout the series. Have him punctuate it with his own remarks. He can hold a conference with a few of his own friends in such a way as to become very personal and direct. In most any lobby and at most any time four or five, or even ten, men may be found, and always you will find some one man who is their leader. They talk by the hour. Here is an opportunity to direct their conversation along lines of thrift. Be sure to advise the leader that he must not discuss items that naturally come under other lectures, but must confine himself to the lecture of the hour. There is no reason why four or five groups of this kind cannot be kept going until the whole series is finished. Do not advertise these meetings beforehand, but leave it to the leader to hold the meeting whenever it suits him best, and to look after his own crowd. This plan necessitates a very close contact of the secretary with the selected leaders, and a very carefully worked out plan. It also means that some report should be made after the groups have finished with each lecture.

Public Meetings

Every secretary is loaded up heavily with responsibilities and naturally does not want to take on new duties. Some feel a lack of ability as platform speakers; platform ability, however, is not the outstanding qualification for the kind of leadership needed in thrift courses.

Suppose we consider the first lecture to illustrate this point. We have in mind a community meeting, well advertised in advance, and held in some centrally located place. There should preferably be some music (local talent) and then bring before the audience the most representative and highly esteemed business man who could not in any way, directly or indirectly, profit by the savings of that particular group. That means the elimination of bankers, real estate agents, insurance agents, etc. They may have their place on this program, but not here. Let this man be one who is known to pay his debts, and who is square with the world, morally as well as financially. Furnish him with the manuscript of the lecture well in advance so that he may familiarize himself with it. Ask him to stick to the topic, and that when the time for the meeting comes to discard the manuscript—to talk from his own experiences within the scope of the lecture. If you can find some man who has made a creditable showing as to thrift on a small wage, whose reputation is good, who will in two or three minutes tell *how* he has saved, rather than how much, it will go a long ways in clinching the statements of your principal speaker. Two, or perhaps three, such experiences would be very advantageous. The Y. M. C. A. secretary, or some one whom he designates, should preside at this meeting, and questions should be re-

MONTHLY RECORD OF INCOME AND EXPENDITURES

Exhibit-Thrift Lecture No. 4

NAME_____

ADDRESS_____ To be kept daily

Month of _____ Year _____

INCOME			EXPENDITURES													
Date	Items	Amount	Rent	Repairs Taxes	Insurances	Food	Clothing	School	Lodge Church	Amsts Recr'n	Medical	Car-fare	Bank	Misc	Total	Date
1	Balance Ford															1
1																1
2																2
3																3
4																4
5																5
6																6
7																7
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29																29
30																30
31																31
Totals for month																
Balance Forward																
Monthly Budget																

Inside of "Income and Expenditure Account" Folder

ceived from the floor provided they pertain to the topic of the evening. Have a banker present who can answer questions regarding banking laws and regulations, but who will in no way advocate the opening of savings accounts. Have him there simply as a referee. Likewise a real estate man who may be able to answer questions relative to real estate (legal transactions) making quite sure in advance that he will not say anything about property values, but will answer only such questions as may come up regarding real estate transactions. He, too, is to act as a referee. Great harm may result if the leader is not careful as to these points. Better not have these men present than to allow them to exploit their business.

Questions may be brought up for debate at these public meetings. "Resolved that it is better to put all the family earnings into one fund, and out of that pay all regular family expenses than have each member act independently," or, "Resolved that it is better to buy all your foodstuffs from one dealer and have only one account, than to buy at various places." "Resolved that it is the duty of the parents to supervise all income and expenses of their children until they are of legal age, even though they may pay their own way regularly," or the negative side might be: "Resolved that children have a right to spend their earnings as they see fit, providing they pay their board and their share of the home expenses." "Resolved that the one who earns the money and supports the home has the right to spend it as he sees fit after the expenses of the home are met." "Resolved that every wage earner is entitled to and should take a vacation every year, even at the expense of losing the time." Other topics can readily be found that will fit into local conditions. These are only suggestions.

Permanent Results

Great care must be used to conserve the good impulses and hearty response in the teaching of this course. Be on the lookout for the fellow who is timid and like the new convert "is afraid he cannot hold out." The secretary and his associates should indicate to such men that they are always ready to help. If good results are to be obtained the housewife must feel that her part is exceedingly important and that if the husband is to succeed he must have her co-operation, and vice versa. One way to conserve the good intentions of both is for clubs of four or five families to be organized in communities where they may gather once a month for a good social time, and where problems may be discussed that have come up during the month. This can very easily deteriorate into a great nuisance, however, and it will take much careful attention to keep it from becoming such: with care it can be made a force for good. As an example, suppose in a certain shop, and living in a certain neighborhood, are seven or ten families, of which five or more have gone into this personal or family account plan. Suppose that at the end of the first month you designate some natural leader of the group and ask him to call his friends to his home for an evening. Use your pleasure about bringing the children, but by all means have the women come. One of the first things that will be discovered is that some kept the plan for ten days, made a slip and quit. Others got further before they quit, and it may be only two out of the group actually finished the job. (Be careful they do not gloat or parade their virtues.) Maybe there are good reasons why some did not finish the task. Encourage them to try it all over again, and then be sure to explain carefully just how the records are kept, for while simple, there are a large number of people who are bewildered with figures. At such meetings take up simple subjects as Potatoes and their rightful place in the bill of fare of the working man's home. Again you will have to be careful because cooks are a jealous lot, but with care a good many valuable lessons may be brought out about as simple a thing as a potato—what potatoes are best, when is the best time to buy, what is the best way to keep them.

Railroad Employees' Children Studying Thrift Exhibit in Railroad Y. M. C. A. Building at Bradford, Ohio

There are a number of subjects that will bring light and inspiration. Likewise this group could discuss coffee, bread, butter and butterine, eggs, etc. Let some school boy read an essay on "Where We Get Sugar," "Where the Coffee is Grown," etc. It will be a fine opportunity for development of the family spirit along thrift lines. Where five or six groups like this are working get them together in a large group every two or three months for a big social at the building. By the time these have been going for a year or two a good many people will have fixed habits of thrift, and will then be outstanding examples of what you have been teaching.

RECORD CARD OF _____

Employed as _____ with _____ RR Co.

MONTH OF _____

Date	From Station	To Station	Total Mileage	At	Earnings	Overtime Earnings	Total Earnings	Remarks (Condr. Train, etc.)
TOTALS FOR HALF MONTH								

SECURE ADDITIONAL COPIES FROM YOUR Y. M. C. A. SECRETARY.

Form for Keeping a Record of Individual Earnings

We are not in sympathy with any desire to get figures on how much more money people are saving than they were, or how many more people have opened up savings accounts, for the life of a savings account is pretty short. If you gather statistics let them be as to the number of men and women who have been keeping records for some time and are becoming confirmed in the habit of thrift. To say 500 people in a community are beginning a personal thrift program, and then have to admit six months later that over 450 of them have

THE HALF YEARLY SUMMARY OF THE FAMILY'S FINANCIAL STANDING

ASSETS: What I own		July 1,	LIABILITIES: What I owe		July 1
ITEMS	VALUE	JAN.1	ITEMS	Amount	Jan.1
House			Mortgage on House		
Furniture			Due on Bldg. and Loan Shrs		
Real Estate			Due on Life Insurance		
Paid on Life Insurance			Due on Stocks, Bonds, Mortgages		
Paid on Bldg. & Loan Shrs			Lodge, Union or Other Dues		
Stocks, Bonds, Mortgages			Real Estate		
Money in Check Bank			Installments on Furniture		
Loans			Borrowed Money		
Accounts Receivable			Bills Payable		
Savings					
TOTAL			TOTAL		
Balance			Deficit		

Record of Financial Standing

fallen by the wayside does not do any good. But to say that in any given community 25 people have been consistent in their record of income and outgo for many months, and that it is an improvement of so much over last year—that is a creditable showing. The secretary should be the good example and so should his associates. He should always be on the alert to aid the man who is discouraged, and help him over the rough places and should be very keen to conserve results.

PRUSSIAN STATE RAILWAYS.—The Prussian Budget now before the Diet includes estimates of $78,250,000 for the State Railways. Of this sum $51,650,000 is asked for new rolling-stock, and "for increasing the capacity of existing lines," an additional $18,125,000 is required.

ACCURATE MACHINE BILLING

Reference has been made previously in these columns to the excellent results which followed the adoption of machine billing on a piece work basis at the Burr Oak (Chicago) transfer station of the Chicago, Rock Island & Pacific. Eight Remington billing machines and one Burroughs calculating machine were installed at this station on May 1, 1914. As these have now been in service almost two years, an idea may be gained of the accuracy of the work secured after the employees have become experienced with the new methods.

In February, 1916, 54,007 tallies were billed by six employees who are paid at the rate of 90 cents per 100 tallies. In this total 249 errors were made or an average of one error in each 208 tallies which is considered an excellent showing owing to the fact that much of the work is done in the rush incidental to the operation of a local freight house office. One man billed 10,808 tallies with only 22 errors. This man has maintained an average rate of 1 error per 400 tallies since the installation of these machines, while for two separate months he reduced his record of errors to 1 in 500. The most rapid operator billed a total of 11,897 tallies in February, working only between 1 and 6.30 p. m. with more or less lost time because of the records coming in from the freight house slowly.

Of the total of 54,007 checked by the revising clerk only 16 errors were undetected and reported later, creating a record of one error in each 3,375 tallies checked. A similar record was made by the extension clerk using the comptometer. Out of 14,080 paid charge items extended in February, 11 errors were made or an average of one in 1,280 items.

In the present organization the billers come on duty at 9 a. m. and work on claims in the forenoon on a piece work basis of 7 cents per claim handled. This work is usually completed at 11 o'clock when the employees go home for lunch, returning and starting on the billing work about 1 p. m. The billing clerks are penalized two points for each error made after the rate exceeds 1 in 200 while each clerk making a record below this is given a clean slate for the month.

The installation of these machines and the reorganization of the office force incident to the installation of the piece work system resulted in a saving of $7,763 in the year 1915, or an average of $647 per month. The saving made by the substitution of machines for billing alone has exceeded $200 per month. Thus the installation of machines has also been found to reduce greatly the number of errors and subsequent claims from loss and delayed freight in addition to saving the time of clerks in other offices in handling these claims. We are indebted to J. W. Lawhead, agent at Burr Oak Transfer, for the above information.

THE IMPORTANCE OF PADUCAH.—"The longest continuous train service route in the world will be the culmination of steps now being taken in Paducah, Ky. It means through train service from Jacksonville (Fla.) to Seattle, Wash. The Nashville, Chattanooga & St. Louis and the Chicago, Burlington & Quincy, have petitioned the city council of Paducah for a right of way through the business district of the city in order to connect the tracks of the two roads. The Nashville, Chattanooga & St. Louis and the Burlington have a contract for connections and joint service." The foregoing, from the Florida Times Union, of Jacksonville, Fla., bears a display head calculated to encourage the citizens of Jacksonville to expect the early establishment of through sleeping car lines between that city and Seattle. Incidentally the benefits of this enterprising action on the part of the press agent will be enjoyed by Atlanta, Chattanooga, Nashville, St. Louis, Billings and other way stations.

THE BILL TO INCREASE THE MEMBERSHIP OF THE COMMERCE COMMISSION

By W. L. Stoddard

WASHINGTON, April 19, 1916.

With almost no debate on its vital features, the House on Monday passed the bill to increase the membership of the Interstate Commerce Commission to nine. This measure (H. R. 308) has been on the calendar for more than a month. It must be remembered, however, that a similar bill was passed by the House ten years ago but failed in the Senate. That the same fate awaits the bill this year is not at all unlikely, though the reasons for pigeonholing it in the upper chamber, as outlined below, are new ones. In addition to increasing the membership of the commission, this bill includes important changes looking toward facilitating the transaction of business. The commission is allowed to subdivide so that members of the commission, instead of agents or examiners, may sit individually in cases. The bill also increases the salary of the secretary to $7,500 a year, a raise of $2,500.

The Interstate Commerce Commission itself has more than once gone on record as endorsing this bill. Shippers have endorsed it. The railroads have endorsed it. The public has endorsed it. "Your committee has long been of the opinion that this bill should pass," declares the House report. "In the sixtieth Congress this committee reported to the House and the House passed a bill increasing the commission to nine members because it was manifestly necessary in order to transact the increasing business of the commission, which had largely been increased by the Hepburn bill of 1906 and other bills."

Two arguments against the proposed increase in membership from seven to nine are heard in the corridors of the capitol. One is that if Congress is about to create a joint committee for the purpose of studying the need for legislation affecting the railroads, the matter of size of the commission should be relegated to that investigation. President Wilson himself thought that the matter of membership should not be referred to the joint committee. Chairman Adamson is authority for the statement that "the President has expressly requested that this bill should be reported separately and passed by Congress, as it is urgently demanded to meet the present emergency."

The other argument against the proposed increase is political in character, and relates to the Senate. There are, as is fairly well known, certain members of that body who are generally called "anti-railroad men." Without mentioning any names, it is enough to point out that it was this group who were responsible for the delay and difficulty over the appointment of Commissioner Daniels, who has since proved to be a valuable and learned member of the commission. If there is a similar group in the House, it is not so well organized as it is in the Senate, and, because the House has nothing to do with confirmations, it has not yet had an opportunity to show its head.

This group in the Senate is responsible for the impression that opposition to the increase in membership in the Interstate Commerce Commission is based on the desire to prevent President Wilson from making additional appointments to the commission. As will be recalled, both Commissioners Daniels and Hall were appointed by Mr. Wilson, and both appointments were fought in the Senate. Several of those who objected to these nominations have stated in private, but not in confidence, that they would strenuously resist any measure which would give Mr. Wilson the duty of selecting additional members of the Interstate Commerce Commission. These Senators declare that the President has played into the hands of the railroads long enough, and that they do not propose to allow him to continue to do so in the future.

It is largely for this reason, in the opinion of men in Washington who are well qualified to know what they are talking about, that the Senate interstate commerce committee has failed to duplicate the action of the House Committee and report the bill to increase the membership of the commission. Senator Newlands, chairman of this committee, has declared that the bill may be reported later, but no prediction as to time has been vouchsafed. As yet the committee has held no hearings at this session on the measure in question, and at this writing the committee announces that none are scheduled.

The legislative jam in Congress materially favors the existence of this situation. Every effort is being made at both ends of the capitol to hasten through with the regular work of the session—the appropriation bills, the Philippine bill, the shipping bill, the conservation bills, the revenue bills, and other big measures. In the general haste and pressure it is the easiest thing in the world for a very few men, animated by whatever motives, to hold up so important a piece of legislation as that increasing the membership of the Interstate Commerce Commission.

BUREAU OF EXPLOSIVES

The bureau for the safe transportation of explosives and other dangerous articles, 30 Vesey street, New York City, has issued the annual report of Colonel B. W. Dunn, chief inspector, for the year ending December 31, 1915. Traffic in commercial explosives has been less active during the past year, the manufacturers being engaged in making immense quantities of war ammunition.

In the transportation of all kinds of explosives during 1915 the total tonnage was considerably greater than in any previous year, but the number of accidents, due to explosives, was small, (11) and the records show no person killed. The number injured was only 6, and the property loss was only $127. The total amount of the losses in the transportation of all those classes of dangerous articles in connection with which the bureau has some supervision was $1,190,965. Over 71 per cent of this sum—namely, $851,348—is charged to inflammable liquids, and this class includes the disaster at Ardmore, Okla., September 27, when a car of gasolene exploded. This case has been reported heretofore in detail. Gasolene has been responsible during the year for 31 other accidents, in 23 of which fires occurred. These accidents and fires caused the death of 12 persons and injuries to 9 others. The number killed at Ardmore was 39 or more.

Lectures to railroad employees are an important branch of the work of the bureau; and the experience of the past year demonstrates the continued need for such instruction and also shows many good results from it. The total number of lectures given during the year was 491, with a total attendance of 41,182.

The total number of boxes of high explosives condemned as unsafe for transportation during the year was 5,785, considerably more than in the preceding year; and the total number of kegs of black powder thus condemned was 163, only about half the number condemned in 1914. The total number of inspections made by the bureau during the year was 13,121. The mileage of the railroads which are members of the bureau is 264,230. The chemical laboratory in 1915 made 1,198 examinations.

About 50 pages of the report are filled with appendices in which are found the reports of the chemical laboratory, circulars issued following the Ardmore explosion, and the other circulars issued by the bureau during the year; also a list of the names of the roads which are members and another of the inspectors. Of these there are 33.

CALL FOR RAILWAY BIDS FOR BOLIVIA—The Bolivian government, through the Bolivian consul general in New York, has called for bids for the construction of the Sucre-Patosi Railroad.

High-Voltage Direct Current Practice*

Five Thousand Volts Recommended As the Ultimate Maximum Toward Which Electric Railways Should Aim

By Clarence Renshaw

Ten years ago, the idea that approximately 600 volts was the maximum potential to be hoped for in the operation of direct current railways was almost as firmly established as was the belief in the days of Columbus that the earth was flat. Then suddenly the plan was suggested of coupling the four 600-volt motors ordinarily employed on interurban cars in pairs of two in series instead of two in parallel, and of connecting the generators in the stations in a similar manner, so as to employ 1,200 instead of 600 volts. Two railways then under construction were willing to try the scheme, although there were some misgivings as to whether it would work or not; it did. The entire railway industry as a result has been given a lesson in open-mindedness which it should not soon forget and the use of direct current voltages of from 1,200 to 1,500 for the operation of interurban railways has become so common that today we are able to discuss details of high voltage direct current practice.

Economic Significance

In studying the development of 1,200- and 1,500-volt practice, the fundamental point which appeals to me is the ease, success and speed with which so radical a departure from previous practice has been carried out. In most developments of so far-reaching a nature, many sources of difficulty are usually overlooked at first and must be cared for in later apparatus at increased expense. In the high-voltage direct current railway system, however, just the opposite has apparently happened. It has therefore been possible to gradually simplify and cheapen the various fundamental parts which go to make up the system instead of having to follow the opposite and more usual procedure.

It is difficult to say whether this exceedingly gratifying condition was due to the more advanced engineering ability of the times, to the inherent simplicity of the direct current railway apparatus, to the very excellent state which such apparatus for 600-volts had reached before its extension to higher voltages was attempted, or to the fact that the jump to 1,200 or 1,500 volts, while seemingly radical, really subjected the apparatus to conditions differing comparatively little from those met with in 600-volt practice.

The general results of the high-voltage direct current system have been to make possible the construction of interurban lines or the electrification of branch steam railroad lines at considerably less expense for a given grade of construction than with 600 volts, or to render possible for a given expenditure the construction of lines capable of handling much heavier traffic. The usual practice has apparently been a compromise between these two possibilities, which has served to finally transfer the electric line from the street car to the real railroad class as far as transportation possibilities are concerned, while still maintaining the relationship and similarity with reference to the simplicity and reliability of the apparatus. With practically no greater expenditure for substations and feeders than the usual 600-volt trolley line, such roads are able to employ freight or passenger trains after the manner of steam lines in accordance with the needs of their business instead of having to restrict them on account of limitations in the distribution of power.

*Abstract of a paper presented at the 320th meeting of the American Institute of Electrical Engineers, New York, April 14, 1916.

2,400 and 3,000 Volt.

The comparative ease with which the use of 1,200- and 1,500-volt direct current was transferred from the realms of uncertainty to the list of everyday standards soon suggested the employment of still higher voltages. Inasmuch as the 1,200-volt system had been brought about by the use of two 600-volt motors in series and as a few motors wound directly for this voltage had been produced with no particular difficulty, the obvious procedure was to continue the geometric progression and connect 1,200-volt motors and generators in series so as to operate at 2,400 volts.

From a technical standpoint, there was apparently no particular difficulty in doing this, and one line installed on this basis has had a remarkably successful record. From a general standpoint, however, while the results have been welcome as a contribution to the development of the art, suitable applications for this particular voltage are apparently somewhat lacking. For trolley roads of the usual interurban class, it has the inherent disadvantage of requiring apparatus which departs too widely from the existing standards with which the operating forces have become familiar, as well as of not lending itself to interchangeable operation over 600-volt lines. For heavy traction, on the other hand, this voltage is much too low to solve the problem in a sufficiently comprehensive way to attract the investment of capital in electrification. Even 3,000 volts, while overcoming the latter disadvantage to some extent, does not do so completely. It is regrettable also that both 2,400 and 3,000 volts have been employed and that in carrying on the upward progress in direct current voltages, 1,500-volt apparatus was not used at once for coupling in series, for carrying on the geometric progression, without the intermediate 2,400-volt step.

Ultimate Limits of D-C Voltage

The general limits upon which standard practice in any industry ordinarily settles are usually fixed by broad economic considerations rather than by physical limitations. It is entirely possible for instance to operate trains at maximum speeds of 90 miles per hour or more, yet the maximum ordinarily attained is from 60 to 80 miles per hour. Physically speaking, also, interurban cars can be run at speeds similar to these, yet the general average on such roads is from 50 to 60 miles per hour. These values have been established by gradual increases from lower ones until without any conscious effort, standardization has been automatically secured.

In the voltages which may be employed with the direct current railway system, there is some tendency toward this same procedure. If no efforts were made to the contrary, it is not improbable that starting from the voltage of 3,000, which we have today on the Chicago, Milwaukee & St. Paul, we would next hear of the employment of 3,600 volts, then possibly 4,200 volts and so on up in corresponding steps. Sooner or later, however, a point would be reached where, by common consent, these increases would stop just as this has happened in the matter of speeds.

While in a way, such a procedure would be the conservative and natural way for progress to come about in the use of higher direct current voltages, its disadvantages are too obvious to require mention. The apparently more radical plan of trying to select in advance the voltage at which such

increases would naturally stop and of going at once to this voltage would hence seem to be the more rational and really the more conservative as far as the general good of the industry is concerned. It has been with this idea in view that our efforts toward the use of direct current at 5,000 volts are being put forth. With practical apparatus for this voltage available, the problems of distributing and collecting the necessary power for the largest locomotives likely to be required can be readily solved so that although further increases might perhaps be possible, they should be entirely unnecessary.

Operation of 5,000-Volt Equipment

The general construction of the 5,000-volt experimental equipment on the Grass Lake line of the Michigan United Traction Company and the results of its first few months' operation have been so widely covered by the technical press that it is unnecessary to refer further to them except to say that the equipment is still in operation on the same successful basis, and that at the time this is written, it has run a little over 30,000 miles. During the five months from October 1 to March 1, the car averaged 5,295 miles per month on a schedule which allows only 15 miles per hour and its record would have been even greater than this had it not been for numerous mechanical difficulties with the trucks, wheels, brake rigging, stove, pilots and other mechanical parts of the car for which the equipment was in no way responsible. During the four months of November, December, January and February, which, on account of weather conditions, are ordinarily considered the worst in the year, the car ran 23,320 miles or an average of 5,830 per month.

During this period the car operated through severe snow, sleet and rain storms and for a short period even ran with two of the commutator covers missing, these having been lost on the road. The motors and control were purposely allowed to go with a minimum of cleaning and other care, and various reports sent in by the men in charge refer to the presence of wheel wash, dirt and other obnoxious substances in the motors and switch groups, although no damage was caused by them.

A half-dozen or so failures have occurred during the winter but these have been mostly in the nature of broken motor leads or similar troubles which served merely to test the lift practicability of the use of such a voltage under the general rough conditions to which car equipments are subjected rather than to indicate any inherent weakness. These troubles showed that this equipment could as easily withstand such ordinary mishaps as any equipment for 600 volts. Only two of the failures were in any way due to the use of 5,000 volts and these consisted of grounds on the grid resistance which took place through the water-soaked flame-proof covering on certain of the leads where the cables had not been properly insulated and supported. Such troubles can be easily guarded against on new equipments.

While as yet only the one equipment now in experimental operation has been built, various designs of other sizes have been considered and with the special double armature type of motor and double jaw type of switch which have made this equipment possible, unusual flexibility in meeting a wide range of conditions can apparently be obtained.

In most of the considerations of the use of direct current voltages of 2,400 and 3,000, there has always been a certain minimum size of motor which could be economically produced and this size has been undesirably large for certain classes of service. With the special double armature type of motor for 5,000-volt equipments, however, the experimental equipment already in use is about as small as would ordinarily be required, although even this is apparently not the minimum limit. On the other hand, the design seems equally adaptable to large sizes.

Conclusion

Broadly viewing the high-voltage direct current practice which we find today, and its significance to the industry, there are four ideas which appeal particularly to me. The pernicious flexibility of the 1,200- and 1,500-volt systems and the innumerable alternatives which they present for application to any definite case in interurban work seem to give timely warning of the great desirability of early standardization in the matter of higher direct current voltages. The comparative ease with which apparatus for these voltages has been developed gives a most encouraging feeling for further development along the same lines. The possibilities which a direct current system at 5,000 volts would offer were the apparatus commercially available make this voltage seem a logical one, and the results obtained with the experimental equipment now in operation give great hope that this voltage may some day be established commercially as a standard of high-voltage direct current railway practice.

Discussion

Owing to the unavoidable absence of the author, the paper was read by N. W. Storer, general engineer, Westinghouse Electric & Mfg Company. Mr. Storer also presented lantern slides illustrating the 5,000-volt equipment which had been described.

Frank J. Sprague spoke at some length as to his early and continuous efforts to establish the use of high voltage direct current for electric traction and pointed out that in 1890 at the Kansas City electric light convention, he illustrated the possibilities of electric operation between New York and Philadelphia by direct current and showed that the potential requirement with one sub-station and with a two-wire system was from 3,600 to 4,000 volts. He then traced the development of the use of high potential direct current in heavy electric traction up to the present Chicago, Milwaukee & St. Paul 3,000-volt installation and to the 5,000-volt installation referred to in Mr. Renshaw's paper. In closing, Mr. Sprague said, "The only time you can compare systems is when you have reached the maximum development of both of them."

William J. Davis, Jr., general foreman of electrification of the Southern Pacific, stated as regards the tendency to higher voltages, that it would appear that the proper voltage would depend on certain limitations as to the maximum tonnage to be hauled and limitations as to speed. The tonnage of a system is dependent upon the number of tracks that are in service and in a single track road, in order to handle heavy tonnage, it is necessary to adopt higher voltages than would be required for a road having sufficient traffic to require two, or three, or possibly four tracks. In the case of a four-track road, all the tracks being in multiple, the drop in voltage in the track is greatly reduced. The advantage of having the proper conductor or the third rail for all four tracks in multiple is also obtained, and even when very large powers are required, say 3,000, 4,000 or 5,000 horsepower on a four-track road, it will be found, insofar as the distribution system is concerned, that modern voltage, say 1,200 or 1,500, would give as good results as could be obtained at 3,000 volts or more, in the case of a single track or double track road.

Mr. Davis also pointed out that with a single track freight road it will be found that upon the basis of the weight of trains now in use, very little improvement in power factor is procured if the substations are placed more than 30 or 35 miles apart. He said the whole problem narrows down to the question as to the number of locomotives required on a given division and their cost. As a general rule the locomotives or rolling stock of a single track road will cost about one-third of the total cost of the electrification. If, therefore, there is a material increase in the cost of a 5,000-volt locomotive as compared with one of 3,000 volts, this

increase in cost may prove the determining factor. In the case of a double-track road in which the locomotives would be greatly increased in number, this difference would be still more sharp and would point to a limitation of voltage possibly less than 5,000 volts as applying to most of the heavy freight traffic now obtaining.

William E. Potter, chief engineer, railway and traction department, General Electric Company, thought the text of the ultimatum (meaning voltage) was very well covered in Mr. Renshaw's statement that "the general limits upon which standard practice in any industry are ordinarily settled are usually fixed by broad, economic consideration rather than by physical limitation." Mr. Potter went on to say that there are several problems that enter into the determination of any economic result. He pointed out that in any electrification, there are certain features which may be considered generally as part of the general scheme. Under direct current operation the initial cost of maintenance and depreciation on some of these features are but little affected by the operating voltage but other features are so material that they have to be a determining influence in the selection of the voltage most favorable to economic results in the ultimate recognition of general standards. The powerhouse transmission lines and track bonding are, he claimed, so little affected by the choice of voltage that these features are not a factor in the economic determination of the particular voltage to be used. The sub-station equipment used in all the established types of apparatus have generally a somewhat higher cost at the higher voltage for a given kilowatt. However, at the higher voltage the stations would be placed further apart and some gain is made in that direction, although not in a direct ratio with a higher voltage. As the amount of included traffic between the sub-stations becomes greater, the individual station has to be of larger capacity.

Mr. Potter also pointed out that the two features which are materially influenced by the voltage are the cost of the feeder copper and the rolling stock. In the determination of the voltage for the Chicago, Milwaukkee & St. Paul, very careful study was made of 3,000 volts and 5,000 volts. There was practically no difference in the initial cost as a whole, but there was a difference in the division of the cost. If the copper was less and the rolling stock was more, the sub-stations would be slightly decreased in the total cost.

It may be of interest to give the percentage cost values that applied to the different elements entered that into the St. Paul electrification as given by Mr. Potter. The high tension transmission line, which extends the entire length of the electrification, was about 10 per cent of the total cost; the overhead construction, the feeder, copper and the trolley, 28 per cent; the bonding of the track about 4 per cent; the sub-stations about 18 per cent, and the locomotives, 20 per cent. The overhead construction and the feeder copper, together with the sub-stations, represent 46 per cent and leaving out the overhead work, which would be essential at any particular voltage, the cost of copper is something less than 40 per cent and the cost of the locomotives also about 40 per cent. Considering the depreciation and maintenance it is better that an equivalent expenditure should be in copper rather than in locomotives and rolling stock, which require maintainence and up-keep. He felt that to economize in copper and to spend that same money for rolling stock is working on the wrong side of the balance sheet.

Another important point brought out in Mr. Potter's discussion was that he judged from experience to date that the trolley on the Milwaukee lines will last anywhere between 20 and 50 years and that it is good for a number of million passages. He said, "The problem of collecting current, so far as 3,000 volts being a limitation is concerned, seems to be effectually disposed of."

Calvert Townley, assistant to the president, Westinghouse Electric & Manufacturing Company, stated that it would be better to put a little more in copper, which was staple and had a lower depreciation, than to put it into the equipment, which had a higher rate of depreciation. We should bear in mind, however, that an increase in the voltage which can be used for transmission is a fundamental and a permanent advance and the resulting saving in copper will always be there.

In closing Mr. Townley maintained that another attractive feature in the development of the high voltage direct current system is that it is one more step towards the universal interchangeability of different kinds of systems. He mentioned the practically universal adaptation of the alternating current generator, the advantages which alternating current has in the matter of transmission over long distances, the advantage of the continuous current motor in its lighter weight and somewhat higher efficiency as used with a rectifier, which is developing very rapidly, enabling a reduction in expenses, an improvement in efficiency, with other advantages, all of which tend to remove the difficulty of the interchangeability of systems. He felt sure that the high voltage continuous current has a very distinct and important place which it will occupy more and more effectively as time goes on.

Benjamin F. Wood, vice-president and chief engineer of the United Gas & Electric Engineering Corporation, of New York, thought that the electrical engineer is getting himself into some difficulty with the railroad people when he talks about costs and the little refinement in connection with the efficiency of the operation. He showed that when the total fuel cost on a trunk line is only 5 or 6 per cent of the operating expense and it is necessary to sell electric power to a steam railroad at approximately the cost of fuel, when operation of electric service is started, it is evident that a saving of 5 or 10 per cent of this fuel percentage is of trifling importance when compared with the dependability of operation. The railroad man wants something he can be sure is going to operate continuously and reliably and that is the thing to which all efforts toward standardization should be directed.

Albert Horace Armstrong, assistant engineer, railway and traction department, General Electric Company, called attention to a statement made by the author, who when referring to 2,400 volts, said that "from a general standpoint, however, while the results have been welcome as a contribution to the development of the art, suitable applications for this particular voltage are apparently somewhat lacking" and also that "for heavy traction on the other hand this voltage is much too low to solve the problem in a sufficiently comprehensive way to attract the investment of capital in electrification. Even 3,000 volts, while overcoming the latter disadvantage to some extent, does not do so completely." Mr. Armstrong felt that those statements rather discredited all the installations now operating at more than 1,500 volts and that it fell flat as an argument considering that one electrification at 3,000 volts is equal in mileage to all the electrifications thus far attempted in the United States.

Referring to the St. Paul electrification, Mr. Armstrong pointed out that in the 440 miles there are 14 sub-stations; that these sub-stations aggregate 59,500 rated full load capacity; that the average load on the entire system would probaby not greatly exceed 16,000 or 17,000 kilowatts, and that the low factor, then, would be less than 30 per cent on the installed capacity, and everyone of the sub-stations has a reserve machine that is not called into service in the normal operation of the road. He also showed that with a higher voltage the sub-stations can be either spaced further apart and the amount of copper which would be used with the lower voltage retained, or less copper can be put in the road and all sub-stations placed near together, or it is possible to compromise and get some of the benefits in each direction.

He showed that on the St. Paul the average feeder copper throughout the whole 440 miles, except on two of the sharper grades, is only 500,000 circular mills and that this copper will give an average drop of less than 10 per cent with the normal operation. He remarked that the drop may reach 20 per cent but, with the average tonnage going over the road, he said he would be greatly surprised if the average drop at the end of the year is over 10 per cent. He pointed out that instead of reducing the capacity of sub-stations it is possible to increase their aggregate capacity with a greater spacing, especially in view of the greater cost of the sub-stations, due to the higher voltage of the apparatus installed, and that it is quite possible the total cost of installation will be greater due to the increase in capacity demanded.

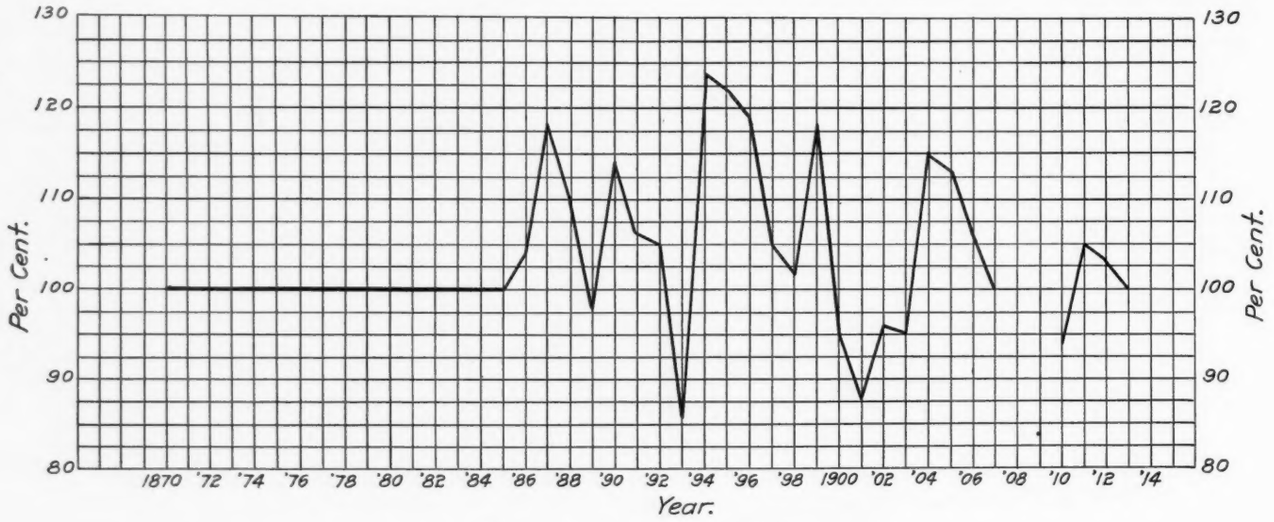
In summing up, Mr. Armstrong said that, relying mostly on Mr. Potter's arguments advancing the 3,000 volts, he could not accept the statement of Mr. Renshaw's that 5,000 volts is the approximately proper voltage to standardize for the steam railway electrification, especially in view of the fact that only one motive power equipment is now operating at this voltage. He added that while the advance to the higher standards has been apparently, to the world at large, a simple matter, he could see that the success attending its use had, in fact, been brought about by the many years of work of some eminent and capable engineers. Mr. Armstrong also pointed out that the paper, itself, did not throw any light on the economic advantage of adopting 5,000 volts nor does it go into the results sufficiently to lead to any conclusion that 5,000 volts is preferable to 6,000 or 7,500 or 10,000, all possible from a direct current standpoint.

In closing the discussion N. W. Storer said he agreed perfectly with Mr. Potter in regard to the economy of the installation and that he had always claimed that it was simply a matter of dollars and cents which is going to ultimately decide the system of electrification that can be used, with the understanding that such a system must give good reliable service in every case and must operate with a reasonable degree of maintenance cost. He did not think that a system which had an enormous cost of maintenance could operate with the greatest reliability. Referring to Mr. Renshaw's purpose in writing the paper Mr. Storer said that he did not believe that Mr. Renshaw had any intention, whatever, of starting out to show that 5,000 volts is a standard voltage which can at once be applied to everything, but simply wished to make it a point to aim at and he said it certainly seemed more logical than to proceed by the small steps which have been made. He pointed out that manufacturers are now required to design apparatus to meet many different systems, really to perform the same work, and in this way the cost of development and manufacture runs up to an enormous figure which must be borne by the operating companies, else it could not be done. He said, "I simply feel, and I know that it was Mr. Renshaw's thought, that we should aim at something which is high enough to do the work."

LOCOMOTIVE VALUATION CHART

By L. R. Pomeroy

In valuing the locomotives of a certain road it was found that fully 90 per cent were built by one company. The list covered a period from the early seventies up to and including 1913. The builders' shop numbers were listed, from which the original specifications and shop costs were located in the builders' records and the writer was made familiar with the figures at which they would reproduce these engines under 1913 conditions. From this data the accompanying curve was drawn, which shows the percentage of the original cost at any given year, to represent "original cost to date." This value was depreciated on an age basis to obtain the present worth. In cases where high class parts or material had been applied, such as steel tired wheels substituted for chilled wheels, etc., the depreciated value of the difference between the value of the lower and higher class material, was added to the present worth so obtained.



Reproduction Costs of Locomotives, 1913

Incidentally, this curve applies to cars as well as locomotives, as about the same percentage of difference in costs of labor and materials, over the periods, would apply. To make the curve apply for any other year the percentages shown should be changed in accordance with the change in prices between 1913 and the year considered. The break in the curve is because no locomotives were ordered in that period.

MANCHURIA.—A press despatch from Peking says that the Chinese government has signed an agreement permitting Russia to construct a railroad in Manchuria from Harbin, on the Siberian Railroad, in a northerly direction across Manchuria to Aigun, near the Russian frontier. The railroad will give to Russia control in Northern Manchuria in compensation for the railway rights granted to Japan in Southern Manchuria. Japan has concurred in this arrangement. Russia will raise funds for construction of the road by floating a loan of $25,000,000.

MULTI-ROUTE INTERLINE TICKETS

A committee of the American Association of Passenger Traffic Officers has been experimenting for some time with a new style of ticket, to include on one form a large number of routes, with the object of effecting a reduction in the expense of maintaining large stocks of interline tickets over various routes. This committee, of which C. A. Cairns, general passenger and ticket agent of the Chicago & North Western, is chairman, has now completed its report and has secured patents on both the "single series" gateway form and the "multi-junction" form, the latter patent having been issued on February 29, 1916.

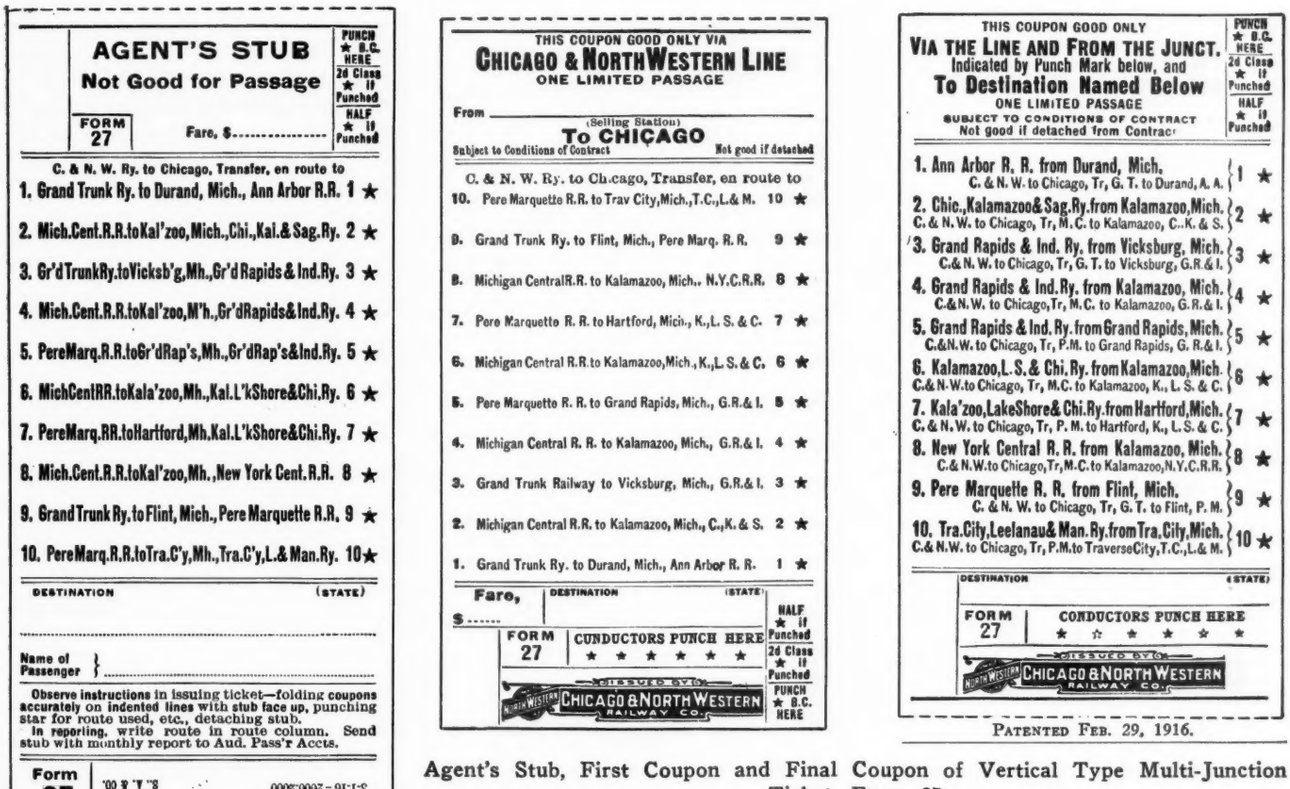
The multi-route ticket marks the result of a well-sustained effort to achieve progress in the form and use of interline passenger tickets. Its distinguishing feature is that it includes in one ticket all of the lines or routes available between common gateways en route from starting point on the initial line to the terminal line reaching the destination, and provides for designating by punch the particular line over which the ticket is thus made to read for each link of the journey. Thus, a multi-route ticket reading from a line west of Chicago via that gateway and Buffalo to a destination on a terminal line east of Buffalo, would carry in one group the names of the lines between Chicago and Buffalo and in the second group the names of the terminal lines from Buffalo eastward to destination over which the ticket could be issued. Such a type confined to a single series of gateways or junctions is called "multi-road" and is illustrated by the reproductions of coupons of Form 150.

Another type carries a group of lines from a common gateway to junctions with immediate connecting lines, and provides for passage via such lines to destinations thereon, and is called a "multi-junction" form and is illustrated by Form 27.

The economy to be obtained from the use of the new forms of tickets depends upon the number of the routes to be covered and the number of lines available between gateways common to them. For example, a multi-route form by the issuing line to Chicago thence via 15 eastbound or southbound lines from Chicago, takes the place of 15 single route forms each reading via Chicago and thence via one of the outgoing lines. A multi-route form via issuing line to Chicago, 5 lines from Chicago to Buffalo and 8 terminal lines from Buffalo, serves in the place of 40 single route forms. A multi-route form westbound via issuing line to Buffalo, 5 lines to Chicago, 6 lines to Omaha and 4 terminal lines from Omaha, would replace 120 single route forms. A multi-route form via issuing line to Buffalo, 5 connecting lines to Chicago, 6 lines to Omaha, 3 lines to Denver and 7 terminal lines from Denver, would replace 630 single route forms.

More routes could be covered than have been included, but it has been deemed best to restrict the tickets to the single series gateway type or to the other type with multi-junctions joined on the same line with the roads to and from them to guard against punching a wrong route, that is, one over lines not connecting.

In issuing these tickets, all of the coupons are folded in their order underneath the agent's stub at the top, and the particular line for each link of the journey is then designated with one punching for each detail through all the coupons, with the ordinary single hole ticket punch. If a ticket is sold as second class or half fare or both, such details are likewise simultaneously punched. In this way, the agent-auditor's stub and each coupon show identical punching of route, etc., which is deemed essential by the accounting departments and the operation of issuing the


AGENT'S STUB
Not Good for Passage
FORM 27
Fare, $.....
PUNCH ★ B.C. HERE
2d Class ★ If Punched
HALF ★ If Punched
C. & N. W. Ry. to Chicago. Transfer, en route to
1. Grand Trunk Ry. to Durand, Mich., Ann Arbor R.R. 1 ★
2. Mich.Cent.R.R.toKal'zoo,Mich.,Chi.,Kal.&Sag.Ry. 2 ★
3. Gr'dTrunkRy.toVicksb'g,Mh.,Gr'd Rapids & Ind.Ry. 3 ★
4. Mich.Cent.R.R.toKal'zoo,M'h.,Gr'dRapids&Ind.Ry. 4 ★
5. PereMarq.R.R.toGr'dRap's,Mh.,Gr'dRap's&Ind.Ry. 5 ★
6. MichCentRR.toKala'zoo,Mh.,Kal.L'kShore&Chi.Ry. 6 ★
7. PereMarq.RR.toHartford,Mh.Kal.L'kShore&Chi.Ry. 7 ★
8. Mich.Cent.R.R.toKal'zoo,Mh.,New York Cent.R.R. 8 ★
9. Grand Trunk Ry. to Flint, Mich., Pere Marquette R.R. 9 ★
10. PereMarq.R.R.toTra.C'y,Mh.,Tra.C'y,L.&Man.Ry. 10★
DESTINATION (STATE)
Name of Passenger
Observe instructions in issuing ticket—folding coupons accurately on indented lines with stub face up, punching star for route used, etc., detaching stub.
In reporting, write route in route column. Send stub with monthly report to Aud. Pass'r Accts.
Form 27
27
THIS COUPON GOOD ONLY VIA
CHICAGO & NORTH WESTERN LINE
ONE LIMITED PASSAGE
From
(Selling Station)
To CHICAGO
Subject to Conditions of Contract
Not good if detached
C. & N. W. Ry. to Chicago, Transfer, en route to
10. Pere Marquette R.R. to Trav City,Mich.,T.C.,L.& M. 10 ★
9. Grand Trunk Ry. to Flint, Mich., Pere Marq. R. R. 9 ★
8. Michigan CentralR.R. to Kalamazoo, Mich., N.Y.C.R.R. 8 ★
7. Pere Marquette R. R. to Hartford, Mich., K.,L. S. & C. 7 ★
6. Michigan Central R.R.to Kalamazoo,Mich.,K.,L.S.& C. 6 ★
5. Pere Marquette R. R. to Grand Rapids, Mich., G.R.& I. 5 ★
4. Michigan Central R. R. to Kalamazoo, Mich., G.R.& I. 4 ★
3. Grand Trunk Railway to Vicksburg, Mich., G.R.& I. 3 ★
2. Michigan Central R.R. to Kalamazoo, Mich., C.,K. & S. 2 ★
1. Grand Trunk Ry. to Durand, Mich., Ann Arbor R. R. 1 ★
Fare, $.....
DESTINATION (STATE)
FORM 27
CONDUCTORS PUNCH HERE
HALF ★ If Punched
2d Class ★ If Punched
PUNCH ★ B.C. HERE
ISSUED BY
CHICAGO & NORTH WESTERN RAILWAY CO.
THIS COUPON GOOD ONLY
VIA THE LINE AND FROM THE JUNCT.
Indicated by Punch Mark below, and
To Destination Named Below
ONE LIMITED PASSAGE
SUBJECT TO CONDITIONS OF CONTRACT
Not good if detached from Contract
1. Ann Arbor R. R. from Durand, Mich. C. & N. W. to Chicago, Tr, G. T. to Durand, A. A. 1 ★
2. Chic.,Kalamazoo&Sag.Ry.from Kalamazoo,Mich. C. & N. W. to Chicago, Tr, M. C. to Kalamazoo, C..K. & S. 2 ★
3. Grand Rapids & Ind. Ry. from Vicksburg, Mich. C.& N. W. to Chicago, Tr, G. T. to Vicksburg, G.R.& I. 3 ★
4. Grand Rapids & Ind.Ry. from Kalamazoo, Mich. C.&N.W. to Chicago,Tr, M.C. to Kalamazoo, G.R.& I. 4 ★
5. Grand Rapids & Ind. Ry. from Grand Rapids, Mich. C.&N.W. to Chicago, Tr, P.M. to Grand Rapids, G. R.& I. 5 ★
6. Kalamazoo,L.S.& Chi.Ry. from Kalamazoo,Mich. C.& N.W. to Chicago, Tr, M.C. to Kalamazoo, K., L. S. & C. 6 ★
7. Kala'zoo,LakeShore& Chi.Ry.from Hartford,Mich. C. & N. W. to Chicago, Tr, P. M. to Hartford, K., L. S. & C. 7 ★
8. New York Central R. R. from Kalamazoo, Mich. C.& N.W. to Chicago,Tr, M.C. to Kalamazoo,N.Y.C.R.R. 8 ★
9. Pere Marquette R. R. from Flint, Mich. C. & N. W. to Chicago, Tr, G. T. to Flint, P. M. 9 ★
10. Tra.City,Leelanau& Man.Ry.from Tra.City,Mich. C.& N.W. to Chicago, Tr, P.M. to TraverseCity,T.C.,L.& M. 10 ★
DESTINATION (STATE)
FORM 27
CONDUCTORS PUNCH HERE
ISSUED BY
CHICAGO & NORTH WESTERN RAILWAY CO.

PATENTED FEB. 29, 1916.

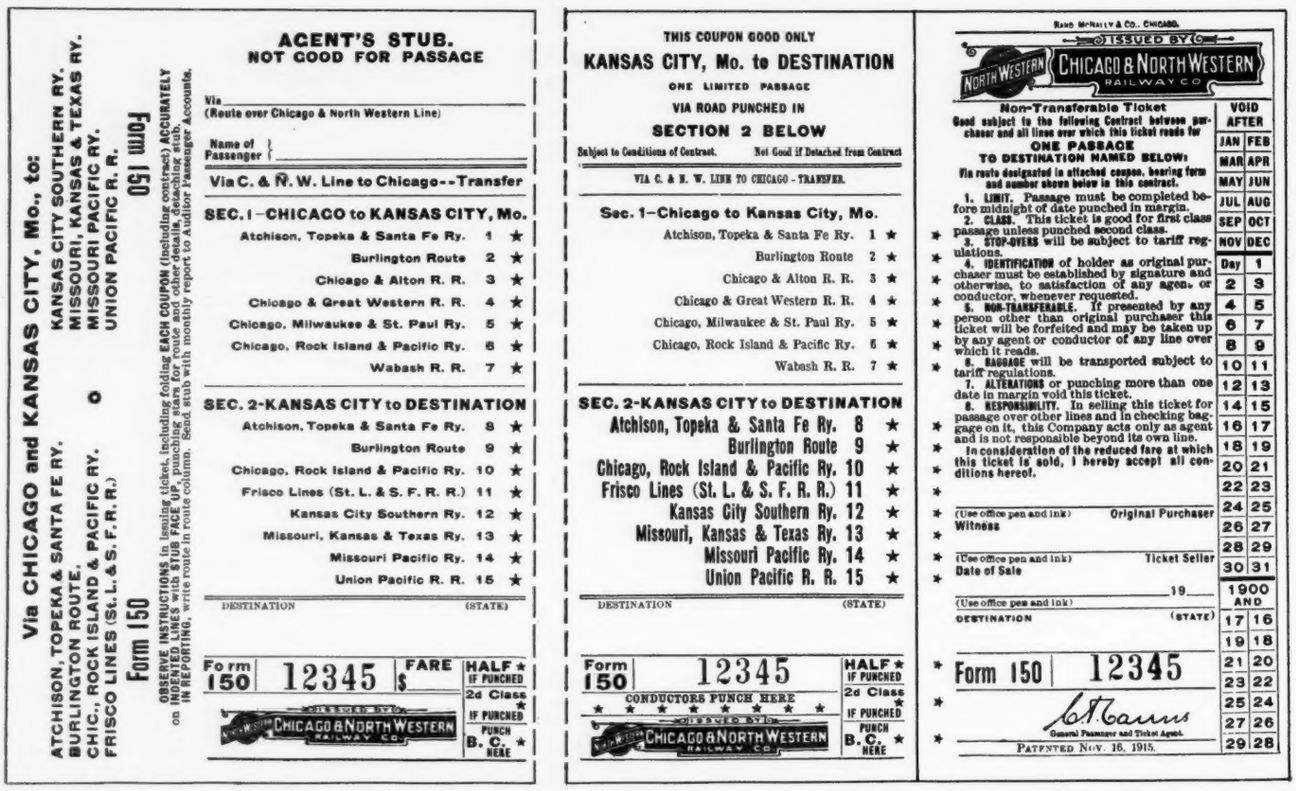
Agent's Stub, First Coupon and Final Coupon of Vertical Type Multi-Junction Ticket, Form 27

ticket via the selected route and designating the other details is simplified.

A number opposite each road in conjunction with the form number indicating the general route of the ticket, may be used to indicate the route over which the ticket is issued.

The tickets are of two types in respect to shape, the original horizontal forms, in which the coupons are arranged in route order from left to right; and the vertical forms with coupons reading from bottom to top, and with the standard width of the ordinary ticket.

In both horizontal and vertical types of tickets, the essential features of arrangement are the same, the points from and to which the coupon reads being shown at the top of the coupon with the name of the road or the reference


Via CHICAGO and KANSAS CITY, Mo., to:
ATCHISON, TOPEKA & SANTA FE RY.
BURLINGTON ROUTE.
CHIC., ROCK ISLAND & PACIFIC RY.
FRISCO LINES (St. L. & S. F. R. R.)
KANSAS CITY SOUTHERN RY.
MISSOURI, KANSAS & TEXAS RY.
MISSOURI PACIFIC RY.
UNION PACIFIC R. R.
Form 150
FORM 150
OBSERVE INSTRUCTIONS in issuing ticket, including folding EACH COUPON (including contract) ACCURATELY on INDENTED LINES with STUB FACE UP, punching stars for route and other details, detaching stub. Send stub with monthly report to Addison Passenger Accounts. IN REPORTING, write route in route column.
AGENT'S STUB.
NOT GOOD FOR PASSAGE
Via
(Route over Chicago & North Western Line)
Name of Passenger
Via C. & N. W. Line to Chicago--Transfer
SEC. 1-CHICAGO to KANSAS CITY, Mo.
Atchison, Topeka & Santa Fe Ry. 1 ★
Burlington Route 2 ★
Chicago & Alton R. R. 3 ★
Chicago & Great Western R. R. 4 ★
Chicago, Milwaukee & St. Paul Ry. 5 ★
Chicago, Rock Island & Pacific Ry. 6 ★
Wabash R. R. 7 ★
SEC. 2-KANSAS CITY to DESTINATION
Atchison, Topeka & Santa Fe Ry. 8 ★
Burlington Route 9 ★
Chicago, Rock Island & Pacific Ry. 10 ★
Frisco Lines (St. L. & S. F. R. R.) 11 ★
Kansas City Southern Ry. 12 ★
Missouri, Kansas & Texas Ry. 13 ★
Missouri Pacific Ry. 14 ★
Union Pacific R. R. 15 ★
DESTINATION (STATE)
Form 150 12345 FARE $
HALF ★ IF PUNCHED 2d Class ★ IF PUNCHED PUNCH B. C. ★ HERE
ISSUED BY
CHICAGO & NORTH WESTERN RAILWAY CO.
THIS COUPON GOOD ONLY
KANSAS CITY, Mo. to DESTINATION
ONE LIMITED PASSAGE
VIA ROAD PUNCHED IN
SECTION 2 BELOW
Subject to Conditions of Contract. Not Good if Detached from Contract
VIA C. & N. W. LINE TO CHICAGO - TRANSFER.
Sec. 1-Chicago to Kansas City, Mo.
Atchison, Topeka & Santa Fe Ry. 1 ★
Burlington Route 2 ★
Chicago & Alton R. R. 3 ★
Chicago & Great Western R. R. 4 ★
Chicago, Milwaukee & St. Paul Ry. 5 ★
Chicago, Rock Island & Pacific Ry. 6 ★
Wabash R. R. 7 ★
SEC. 2-KANSAS CITY to DESTINATION
Atchison, Topeka & Santa Fe Ry. 8 ★
Burlington Route 9 ★
Chicago, Rock Island & Pacific Ry. 10 ★
Frisco Lines (St. L. & S. F. R. R.) 11 ★
Kansas City Southern Ry. 12 ★
Missouri, Kansas & Texas Ry. 13 ★
Missouri Pacific Ry. 14 ★
Union Pacific R. R. 15 ★
DESTINATION (STATE)
Form 150 12345
CONDUCTORS PUNCH HERE
HALF ★ IF PUNCHED 2d Class ★ IF PUNCHED PUNCH B. C. ★ HERE
ISSUED BY
CHICAGO & NORTH WESTERN RAILWAY CO.
Rand McNally & Co., Chicago.
ISSUED BY
NORTH WESTERN CHICAGO & NORTH WESTERN RAILWAY CO.
Non-Transferable Ticket
Good subject to the following Contract between purchaser and all lines over which this ticket reads for
ONE PASSAGE
TO DESTINATION NAMED BELOW:
Via route designated in attached coupon, bearing form and number shown below in this contract.
1. LIMIT. Passage must be completed before midnight of date punched in margin.
2. CLASS. This ticket is good for first class passage unless punched second class.
3. STOP-OVERS will be subject to tariff regulations.
4. IDENTIFICATION of holder as original purchaser must be established by signature and otherwise, to satisfaction of any agent or conductor, whenever requested.
5. NON-TRANSFERABLE. If presented by any person other than original purchaser this ticket will be forfeited and may be taken up by any agent or conductor of any line over which it reads.
6. BAGGAGE will be transported subject to tariff regulations.
7. ALTERATIONS or punching more than one date in margin void this ticket.
8. RESPONSIBILITY. In selling this ticket for passage over other lines and in checking baggage on it, this Company acts only as agent and is not responsible beyond its own line.
In consideration of the reduced fare at which this ticket is sold, I hereby accept all conditions hereof.
(Use office pen and ink) Original Purchaser
Witness
(Use office pen and ink) Ticket Seller
Date of Sale 19
(Use office pen and ink)
DESTINATION (STATE)
Form 150 12345
General Passenger and Ticket Agent.
PATENTED NOV. 16, 1915.
VOID AFTER
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Day 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
1900 AND
17 16 19 18 21 20 23 22 25 24 27 26 29 28

Agent's Stub, Final Coupon and Contract of Horizontal Type Multi-Route Ticket, Form 150

to the section in which the road is punched, and the name of the issue line at the bottom of the coupon. In the body of the ticket, the groups of lines are shown in geographical order. The matter is arranged so that the details are in the same relative position and register accurately when the coupons are folded for punching.

The intention is to determine by practical use for a sufficient period, which type, horizontal or vertical, is preferable and best adapted for the purpose from the standpoint of the agent, the passenger, the conductor, the passenger department and the auditor. The tickets have been used by some of the roads for some time; and, with the patent question settled by the association, it is expected that they will be more generally used and that with the aid of the association ticket committee, a satisfactory consensus of opinion as to which is the better type of ticket will be reached before long.

The horizontal forms have thus far been deemed to be more clear and to afford the better record for the accounting departments, as the details of route, etc., cannot be punched without folding the coupons, while the vertical forms are favored by some as having more nearly the appearance of regular single route tickets and being a trifle cheaper.

The multi-route tickets require more paper and printing and therefore cost more per ticket than the single route tickets. However, they carry a number of active routes on one ticket and tickets can be ordered in large quantities at some reduction. A large saving is also made possible by the reduction of waste of unsold and inactive single route tickets which would otherwise have to be carried in ticket stocks to afford reasonable territorial representation, and of the clerical work necessary to carry the record of a large number of single forms of tickets in the station ticket accounts and in the auditors' offices.

The multi-route tickets referred to have now been approved as standard by the American Association of Passenger Traffic Officers after having been perfected by committees of the association. The entire subject was given exhaustive study for several years and the horizontal type was first perfected and submitted for approval. The vertical type was a later thought and was adapted from the horizontal form in response to a desire to give both styles of ticket a fair test. The single series gateways forms are protected by patent of November 16, 1915, and the multi-junction tickets by patent of February 29, 1916. Rights in the patents were assigned to the secretary of the association and his successors in office as trustee for the purpose of securing the free use of these ticket forms by the transportation lines of the country.

This is the result of the association's continued efforts to perfect and standardize interline tickets and ultimately to secure uniform adoption of the kind and type found to be the best, so that passengers, conductors, agents and auditors' clerks, on becoming familiar with one road's issue of interline tickets, will as readily understand and handle the similar interline tickets of other roads.

Recent Examples of 2-10-2 Type Locomotives

Large Freight Engines for Two Roads Are Fitted With Lateral Motion Driving Boxes on the Leading Axles

Vanadium Cast Steel Frame for New York, Ontario & Western Engine.

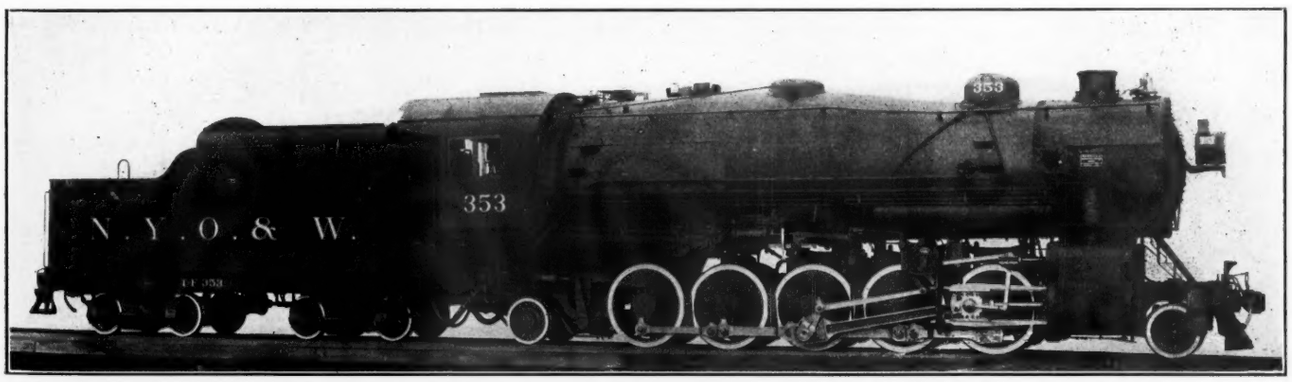
THE American Locomotive Company has recently delivered twelve 2-10-2 type locomotives to the New York, Ontario & Western and five to the Erie Railroad. The 2-10-2 type has formerly been handicapped by its long, rigid wheel base. The application of lateral motion driving axles and boxes to these locomotives was made for the purpose of reducing the rigid wheel base to that which is in common use on locomotives of smaller capacity and at the same time securing the advantages of the ten-coupled wheel arrangement with the resulting increased capacity of the locomotive.

These figures for rigid wheel base shown in the table are well within the figures used on a very large number of Mikado and Consolidation type locomotives in service throughout the country.

	Driving Wheelbase	Rigid Wheelbase
N. Y. O. & W.	20 ft. 0 in.	15 ft. 0 in.
Erie	22 ft. 6 in.	16 ft. 6 in.

ing shoe being placed upon the inner side of the main frames to prevent side motion. Between this cross member and the bridge or spacing member are interposed two inverted rockers designed so that a lateral force equal to 20 per cent of the weight transmitted is required to deflect them from their normal position. When the boxes are deflected by a side movement of the first pair of driving wheels from their normal central position, the boxes and the bridge casting are moved laterally in reference to the member carrying the springs. This movement deflects the inverted rockers which offer a definite resistance against the motion. The spring and equalizer work is not shifted from its normal position when the boxes are deflected laterally.

It will be seen from the photograph and drawings that one side of the bridge member is carried below the driving axle with a bolting flange. This is provided for the at-

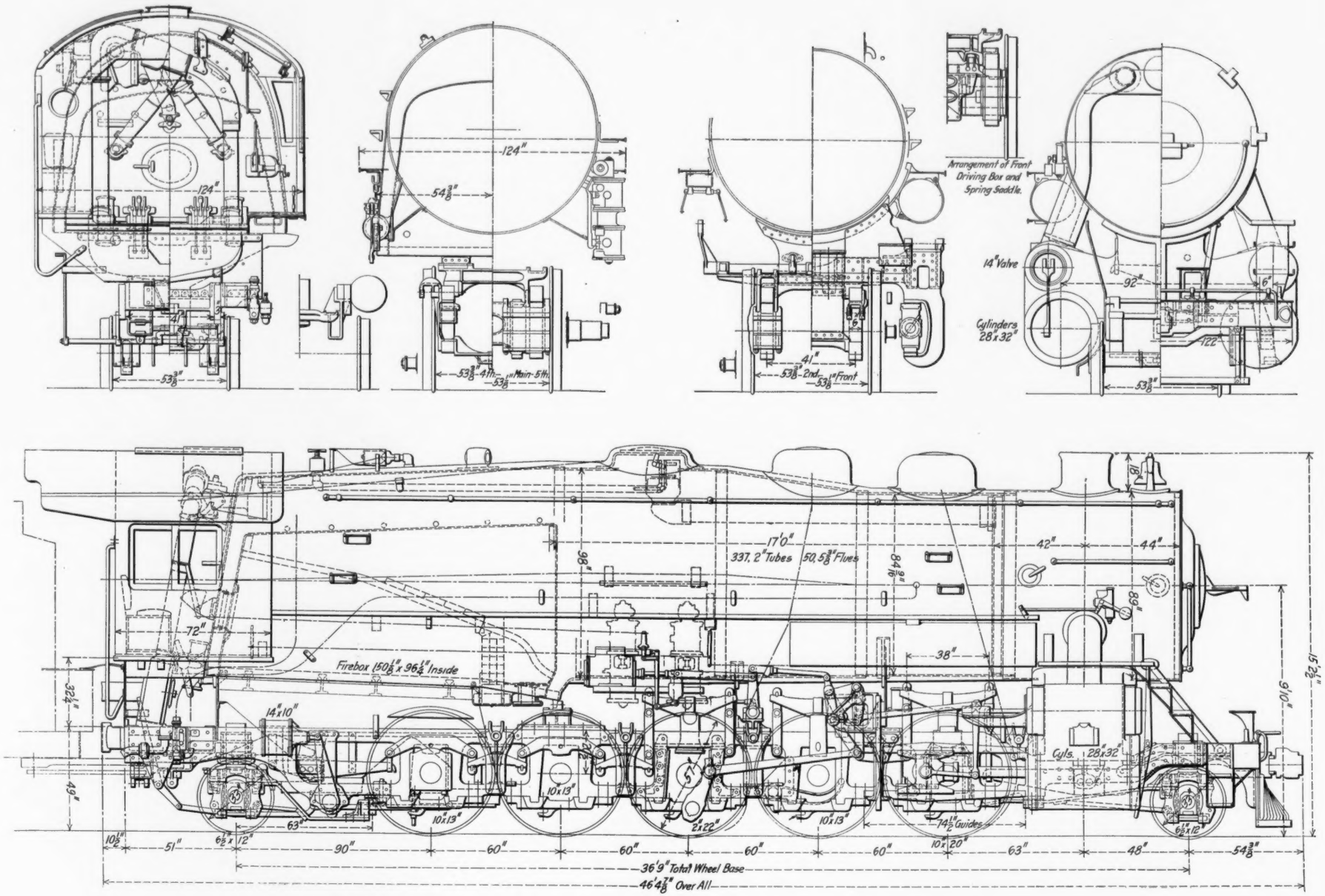


New York, Ontario & Western 2-10-2 Type Locomotive

The lateral box arrangement consists of two independent driving boxes, whose lateral centers are about on a line with the inside of the main engine frames. These two driving boxes are held in a fixed relation to each other by a bridge or spacing member which engages the inner flanges of the boxes. The weight which is transmitted through this bridge member is applied to the boxes on their transverse centers. The lugs on the spacing member which engage the inner flanges of the boxes are for the sole purpose of maintaining the proper spacing of the boxes and do not transfer any vertical load. The driving springs are in about the normal position and are carried on a cross member which has a vertical movement only between the engine frames, a wear-

tachment of a finger to guide the brake beam and insure that the brake heads register properly with the tires on the leading drivers.

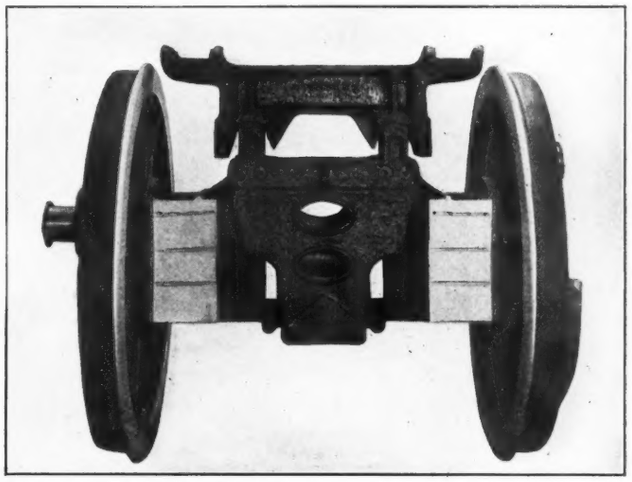
The rod connections between the first and second drivers are arranged with a ball knuckle joint ahead of the pin on the second driver, which allows for the necessary deflection of the side rods. The construction of the crank pin and rod bearing at the first driver is clearly shown on the drawing. It consists of an ordinary design of cylindrical crank pin, on which is placed a hard bronze bushing, the interior being bored cylindrical and the outside turned to a spherical surface. Encasing this bushing are two pieces of hard steel which are held in place in the rod end with a wedge, in the



General Arrangement of the New York, Ontario & Western 2-10-2 Type Locomotive

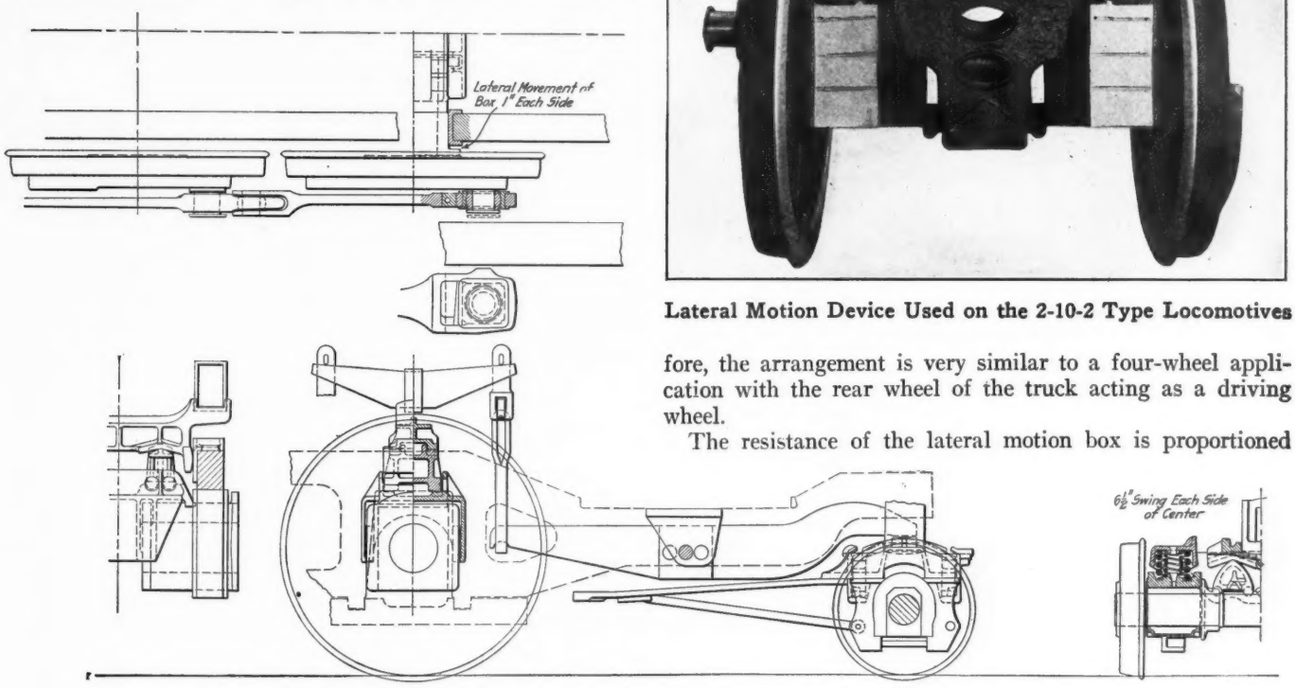
same manner as two ordinary brasses. The bushing can revolve either on the crank pin or within the two steel pieces. When the rod is deflected from the normal position, the spherical bushing allows the parts to rotate sidewise around the center of the front crank pin; at the same time the bushing can revolve on the cylindrical portion of the pin. Several oil holes are provided through the bronze bushing to insure lubrication of both the spherical and cylindrical surfaces.

The operation of the lateral motion axle should be considered in connection with the engine truck. The driving springs of the first and second axles are equalized in the usual manner with the engine truck; therefore, the weight on the engine truck center pin and the lateral motion boxes on the first axle is divided in proportion to the arms of the front equalizer. The engine truck is of the inverted rocker type, having a resistance of 50 per cent. against the initial movement, and, as previously stated, the resistance of the lateral device at the first driver is 20 per cent. These resistances are so chosen in relation to the weight coming upon each centering device that the lateral resultants at the engine truck and first driver are about the same in amount. It will thus be seen that in effect, the engine truck and the first driver act in practically the same way as a four-wheel engine truck in guiding the front of the locomotive, except that the lateral resistance is applied in the plane of each wheel instead of being applied midway between the wheels and divided between them as in the case of a four-wheel truck. As far as guiding the engine is concerned, therefore, the arrangement is very similar to a four-wheel application with the rear wheel of the truck acting as a driving wheel.

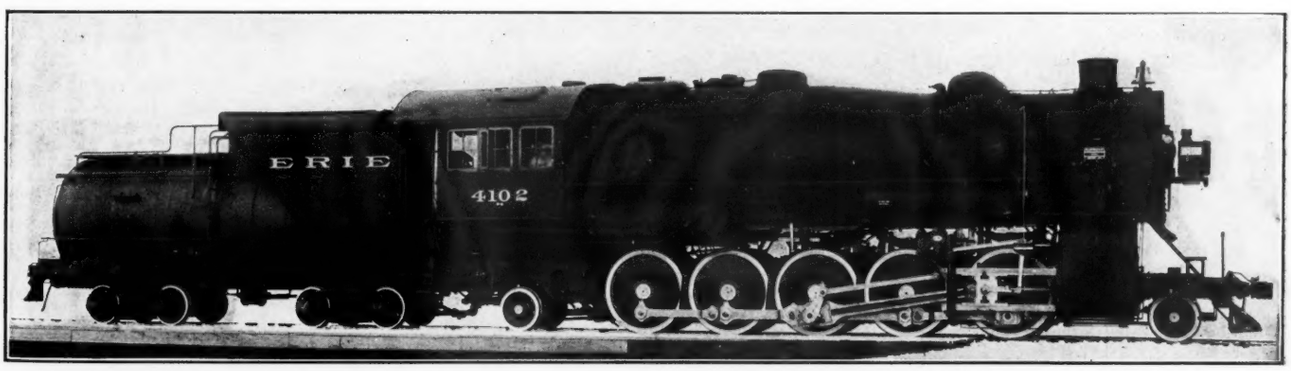


Lateral Motion Device Used on the 2-10-2 Type Locomotives

The resistance of the lateral motion box is proportioned with the idea of providing enough initial resistance so that for any ordinary road service on tangent track or curves the first driver will remain in normal position, and will deflect only when passing through turnouts and yard curves.



Arrangement of the Lateral Motion Journal Boxes and the Side Rods



Santa Fe (2-10-2) Type Locomotive for the Erie Railroad

The operation of the device in service has clearly demonstrated the correctness of the design in this particular. A close inspection of the engines in operation discloses the fact that the lateral motion driver very rarely deflects when the engine is running on the road. When the locomotive passes through sharp turnouts or is operating in yards, the lateral motion driver will deflect, thus preventing the cramp-

ing of the driving wheelbase in the curve and excess pressure upon the driving wheel flanges.

It should be noted that the action of the rockers provides a limit to the lateral pressure which can be placed upon the first driving wheel flange. When this lateral resistance exceeds 20 per cent of the weight carried upon the lateral motion rockers the boxes will deflect, the excess lateral pressure being then transferred to the second driver, thus dividing the work of guiding the engine through curves between the truck and the first and second drivers instead of the truck and the first driver only as in the ordinary ten-coupled arrangement.

This lateral motion driving box can also be applied to engines having four-wheel trucks. The device has been patented.

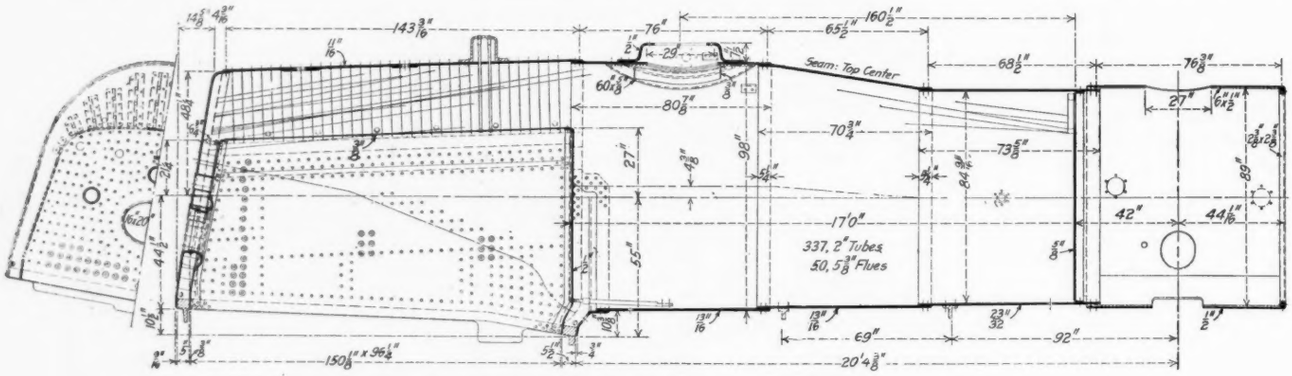
In the ordinary design of 2-10-2 type locomotive, about 80 per cent of the total weight of the engine is on the drivers. It is therefore interesting to note the increase which has been obtained on these new engines, as shown in one of the tables:

	Total Weight	Weight on Drivers	Percentage
N. Y. O. & W.	352,500	293,000	83.2
Erie	401,000	335,500	83.7

Careful attention was given to the boiler design, and the boilers of both engines have the advantage of short tube length and large diameter. A short tube length not only gives greater evaporative value per square foot of heating surface, but also reduces back pressure and consequently increases the power of the engine. Large boiler diameter combined with short tube length gives a large volume of water where the evaporative value is the highest.

The distance is short from the rear wheel to the draw bar in both engines. This not only makes the engine ride easier on curves, but it reduces the friction between the flange of the wheel and the rail.

The engines are equipped with superheaters, a combination Gaines and Security arch, Street stokers, Baker valve gear, Ragonnet air reverse gear, Chambers throttle valve. Economy front and rear trucks, and vanadium cast steel frames. One of the frames for the New York, Ontario & Western engines is illustrated herewith. They were made by the Union Steel Casting Company and are the largest and heaviest cast steel frames of which the makers have record. They are 6 in. wide, 41 ft. 7 in. long, and each casting weights 13,250 lb. As will be seen from the results of tensile tests of coupons from 12 of the frames, given in the accompanying table, the castings show uniform and high physical properties well above the adopted specifications for vanadium cast steel frames. Tests of the other 12 frames show the same high properties. Tests from the 24 castings, representing 12 melts, gave the following average physical properties:



Boiler of the New York, Ontario & Western 2-10-2 Type Locomotive

Results of Tests of Vanadium Steel Frames

Melt No.	Elastic limit. Lb. per sq. in.	Tensile strength. Lb. per sq. in.	Elongation in 2 in. Per cent	Reduction of area. Per cent	Carbon. Per cent	Manganese. Per cent	Silicon. Per cent	Phosphorus. Per cent	Sulphur. Per cent	Vanadium. Per cent
57c	44,610	72,680	29.0	51.8	.22	.60	.26	.038	.034	.19
65c	48,620	85,220	22.5	47.6	.24	.64	.30	.041	.032	.19
57c	45,110	76,200	26.5	51.8	.22	.60	.26	.038	.034	.19
65c	46,620	78,200	25.0	46.1	.24	.64	.30	.041	.032	.19
66c	48,120	82,700	23.5	47.6	.23	.61	.296	.037	.031	.185
66c	46,620	76,200	28.5	53.1	.23	.61	.296	.037	.031	.185
68c	47,810	80,520	24.5	50.2	.25	.64	.30	.041	.031	.185
68c	47,310	78,010	28.5	50.2	.25	.64	.30	.041	.031	.185
72c	46,120	72,690	28.5	51.8	.23	.57	.259	.036	.032	.180
72c	46,800	74,240	27.0	48.8	.23	.57	.259	.036	.032	.180
73c	47,310	74,980	27.0	45.9	.24	.60	.254	039	.030	.185
73c	46,620	72,690	26.0	54.5	.24	.60	.254	.039	.030	.185

Elastic limit, lb. per sq. in.	47,000
Tensile strength, lb. per sq. in.	78,500
Elongation in 2 in., per cent.	26
Reduction of area, per cent.	49

The following table shows the contrast between these physical properties, obtained by means of vanadium with steel containing only .22 per cent to .25 per cent of carbon, and those provided in the Master Mechanics Association's latest proposed specifications for cast steel frames:

Chemical Composition

	Grade A	*Grade B
Carbon, per cent.	0.25—0.37	0.37—0.50
Manganese, per cent.	0.40—0.75	0.40—0.75
Phosphorus, per cent.	Not over 0.05	Not over 0.05
Sulphur, per cent.	Not over 0.05	Not over 0.05

*When high carbon steel frames are specified this grade shall be used.

Physical Properties (Minimum)

	Grade A	Grade B
Elastic limit, lb. per sq. in.	30,000	35,000
Tensile strength, lb. per sq. in.	65,000	75,000
Elongation in 2 in., per cent.	20	15
Reduction of area, per cent.	28	22

The following table gives the principal dimensions and data for both engines:

General Data

	Erie, 2-10-2	New York, Ontario & Western, 2-10-2
Gage	4 ft. 8½ in.	4 ft. 8½ in.
Service	Freight	Freight
Fuel	Bit. coal	Bit. coal
Tractive effort	83,000 lb.	71,200 lb.
Weight in working order	401,000 lb.	352,500 lb.
Weight on drivers	335,500 lb.	298,500 lb.
Weight on leading truck	34,000 lb.	30,000 lb.
Weight on trailing truck	31,500 lb.	24,000 lb.

General Data—(Continued)

Weight of engine and tender in working order	585,000 lb.	521,200 lb.
Wheel base, driving	22 ft. 6 in.	20 ft.
Wheel base, total	40 ft. 3 in.	36 ft. 9 in.
Wheel base, engine and tender	71 ft. 9½ in.	66 ft. 10 in.

Ratios

Weight on drivers ÷ tractive effort	4.05	4.21
Total weight ÷ tractive effort	4.83	4.95
Tractive effort × diam. drivers ÷ equivalent heating surface*	760	677
Equivalent heating surface* ÷ grate area	72.4	75
Firebox heating surface ÷ equivalent heating surface,* per cent	4.97	5.42
Weight on drivers ÷ equivalent heating surface*	48.8	49.7
Total weight ÷ equivalent heating surface*	58.4	54.2
Volume both cylinders	27.9 cu. ft.	22.7 cu. ft.
Equivalent heating surface* ÷ vol. cylinders	246	264
Grate area ÷ vol. cylinders	3.4	3.5

Cylinders

Kind	Simple	Simple
Diameter and stroke	31 in. by 32 in.	28 in. by 32 in.

Valves

Kind	Piston	Piston
Diameter	16 in.	14 in.
Greatest travel	6½ in.	6¾ in.
Outside lap	1 in.	1 1/16 in.
Inside clearance	1/16 in.	
Lead in full gear	3/16 in.	⅛ in.

Wheels

Driving, diameter over tires	63 in.	57 in.
Driving, thickness of tires	7 in.	7 in.
Driving journals, main, diameter and length	13 in. by 22 in.	12 in. by 22 in.
Driving journals, front, diameter and length	11 in. by 19 in.	10 in. by 13 in.
Driving journals, others, diameter and length	11 in. by 13 in.	10 in. by 13 in.
Engine truck wheels, diameter	33 in.	33 in.
Engine truck, journals	6½ in. by 14 in.	6½ in. by 12 in.
Trailing truck wheels, diameter	33 in.	33 in.
Trailing truck, journals	6½ in. by 14 in.	6½ in. by 12 in.

Boiler

Style	E. W. T.	E. W. T.
Working pressure	200 lb. per sq. in.	190 lb. per sq. in.
Outside diameter of first ring	92⅝ in.	86 in.
Firebox, length and width	160 in. by 108¼ in.	150⅛ in. by 96¼ in.
Firebox plates, thickness	Crown, sides, back, ⅜ in.; tube, ⅝ in.	Crown, sides and back, ⅜ in.; tube, ½ in.
Firebox, water space	6 in.	Front, 5½ in.; sides and back, 5 in.
Tubes, number and outside diameter	317—2¼ in.	337—2 in.
Flues, number and outside diameter	60—5½ in.	50—5⅜ in.
Tubes and flues, length	17 ft.	17 ft.
Heating surface, tubes and flues	4,617.5 sq. ft.	4,173 sq. ft.
Heating surface, firebox	† 341.6 sq. ft.	† 325 sq. ft.
Heating surface, total	4,959.1 sq. ft.	4,498 sq. ft.
Superheater heating surface	1,274.2 sq. ft.	1,007 sq. ft.
Equivalent heating surface*	6,870 sq. ft.	6,008.5 sq. ft.
Grate area	94.8 sq. ft.	80.2 sq. ft.
Smokestack, diameter	23 in.	21 in.
Smokestack, height above rail	16 ft. 3 7/16 in.	15 ft. 0½ in.

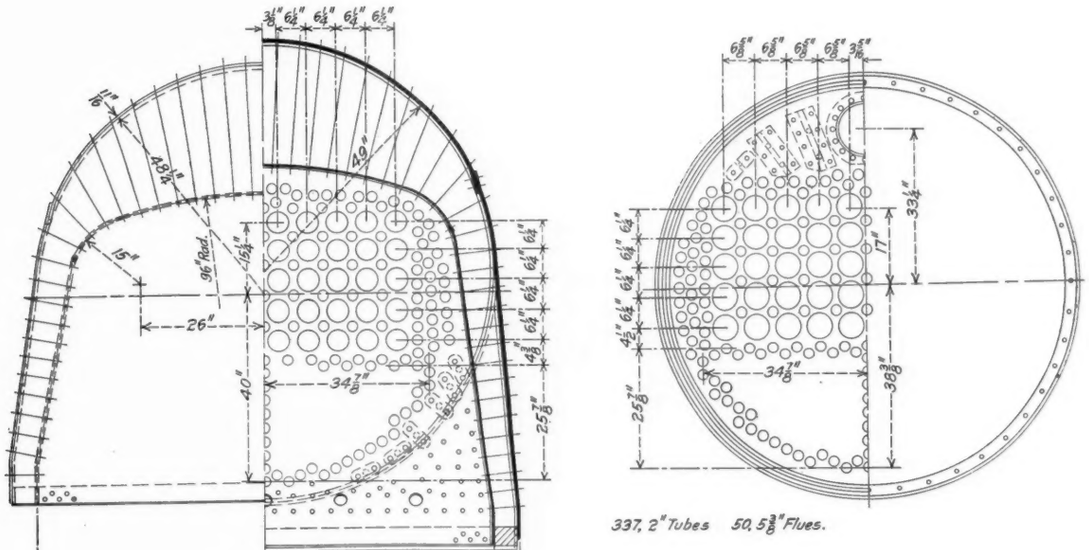
Tender

Tank	Vanderbilt	Water bottom
Weight	184,000 lb.	168,700 lb.
Wheels, diameter	33 in.	33 in.
Journals, diameter and length	6 in. by 11 in.	6 in. by 11 in.
Water capacity	10,000 gal.	9,000 gal.
Coal capacity	19 tons	15 tons

*Equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.
†Includes arch tube heating surface.

PASSENGERS BURNED TO DEATH AT BRADFORD, RHODE ISLAND

In a rear collision of westbound passenger trains on the New York, New Haven & Hartford at Bradford, R. I., about 7:30 p. m. April 17, one passenger car, occupied by about 35 passengers, was crushed and immediately afterward took fire; and four passengers and one employee riding as a passenger were killed and about 30 passengers were injured. Two or more of the passengers lost their lives in the flames, which spread so rapidly that rescue was impossible.



Cross Sections of the Boiler

Bradford, formerly called Niantic, is on the main line, between Providence and New London, 23 miles east of New London. Local passenger train No. 633, behind time because of trouble with the engine, was entering the side track at Bradford when it was run into at the rear by a following express passenger train, No. 25, which approached at uncontrollable speed, said to have been, at the moment of collision, about 15 miles an hour. Train No. 633 consisted of an engine and three wooden cars. The rear car was crushed for half its length. Fire at once started in the wreck, and was rapidly spread by gas from a ruptured gas tank beneath the passenger car; and the flames were soon uncontrollable. There was no town fire department and no water at hand; and all of the cars of train 633, together with the station buildings, were destroyed. Only slight injuries were sustained by persons on train 25.

The engine of train 25 remained on the rails and was not disabled; and the train was backed away from the wreck before the fire had gained much headway; but immediately thereafter the fire reached some barrels of gasoline in the freight house and there was a violent explosion.

This section of the road is operated under the controlled manual block system. There is a home signal about 800 ft. in the rear of the point where the collision occurred and the corresponding distance signal is 4,700 ft. farther back. The engineman of train 25 was C. H. Mansfield, a runner of 29 years' experience, with a good record. He told an officer of the road that the distance signal was clear. He appears to have passed it at full speed. He read correctly the home signal, which was at stop, and then applied brakes, but too late. He says that he discerned the home signal, the hand signal of the flagman of train 633 and the tail lights of that train, all at about the same time. This flagman was back about 700 ft.

A signal inspector of the road was on train 25 and he, with the flagman of that train, within a few minutes after the collision, got back about 4,000 ft. They say that there was a slight mist, not a fog. They found the home signal plainly visible when they were 124 rail lengths (about 3,800 ft. to 4,000 ft.) in its rear. They found the distant signal at caution.

Following the collision at Milford, Conn., February 22, all enginemen had been instructed to reduce speed at all adverse distant signals; and Engineman Mansfield had been tested on this requirement on March 31, when his conduct was found satisfactory.

The New York Times gives the following details:

"The locomotive of the express train penetrated for twelve feet the rear end of the local. The smashing of gas lamps in the coach spread fire instantly through the coach and over the locomotive, the cab itself catching fire. Using a fire extinguisher, Engineer Mansfield put out the flames in the cab and then started to back out, the locomotive dragging with it a yoke of smashed and burning woodwork which covered the stack and all the forward part of the boiler.

"The rear end of the last car of the local had been jammed. The floor, sides, and top were crumpled. Most of the passengers in the car were caught and held by masses of wood and ironwork of the seats in which they were sitting, and the seats just ahead of them. Only two passengers in the rear car escaped these traps and were able to scramble toward the front door, when fire from the gas lamps began to spread to the débris.

"Several men, who made their way into the car from the outside, helped them to get out." While attempts were being made to rescue the imprisoned passengers an explosion occurred below the floor of the car, and in a few seconds the interior of the car was ablaze from one end to the other. Those on the outside could hear the shrieks for a few seconds, but could give no aid.

RAISING MONEY BY SAVING IT

H. C. Nutt, general manager of the San Pedro, Los Angeles & Salt Lake, has issued a circular to the employees of the railroad asking their co-operation in the campaign of the railroad to reduce freight loss and damage claims. The circular is copyrighted by Howard Elliott, inspector of transportation, and says, in part:

"I want to *raise thirty thousand dollars* this year for the Salt Lake Road.

" '$30,000. *Marked down from* $60,000!' is the way I want to list our freight claim account in the next inventory.

"To do this, last year's loss and damage payment must be cut squarely in half.

"Each employee is hereby granted *a share* in this enterprise; whether your holdings yield *dividends* depends upon *you* and your manner of treating the company's property.

"Saving $30,000 is just as truly *raising money* as floating a stock issue or giving a mortgage. And it is a far better way. *Raising money* by saving it eliminates interest; on the other hand, it holds old and creates new business by the satisfaction that comes from receiving shipments in good order.

"Let us put our loss and damage department out of business. No need to waste sympathy on those deprived of employment. We can set them to soliciting business or hurrying the release of cars, or helping at stations where traffic increases as a result of our reputation for doing things the careful way. There are dozens of places where their services can be utilized in our program of *raising money.*"

STEEL PASSENGER TRAIN EQUIPMENT

The Special Committee on Relations of Railway Operation to Legislation has issued bulletin No. 79 showing the progress in the building of steel and steel underframe passenger equipment and the cost of reconstruction in steel of the present wooden passenger equipment, on the railroads in the United States. The bulletin is based on the compilation of replies from 290 companies operating 236,167 miles in the United States, 61,728 passenger equipment vehicles, with 1,094 under construction on January 1, 1916.

Of the cars under construction on January 1, 1,075 were all-steel, 16 steel underframe and only 3 of wood, and of the 1,696 cars acquired in the calendar year 1915, 1,250 were all-steel, 340 were steel underframe and 106 were wood. Of the total number of passenger train cars in service on December 31, 1915, 14,286 were all-steel, 6,060 were steel underframe and 41,382 were wood. The character of the various classes of equipment in service on December, 1915, is shown in the following table:

	Steel	Steel underframe	Wood
Postal	885	197	431
Mail and baggage	755	427	2,405
Mail, baggage and passenger	27	37	557
Baggage and passenger	641	270	3,334
Baggage or express	1,585	1,419	7,173
Passenger	5,697	1,724	21,612
Parlor, sleeping, dining	3,651	1,730	4,831
Business	33	138	716
Motor	1,012	118	323
Total	14,286	6,060	41,382

A table is also given in the bulletin showing that for the cars acquired during the past seven years, the percentage of all-steel cars has increased from 26 in 1909 to 73.7 in 1915, while the percentage of steel underframe cars has ranged from 14.08 per cent to 30.04 per cent and was 20.01 per cent in 1915. The percentage of new wooden cars built has decreased steadily from 51.04 per cent in 1909 to 0.2 per cent in 1914.

The number of wooden cars in service January 1, 1912, was 48,126. There are now in service approximately 41,382, indicating the retirement from service of 6,744 in three years. Of this number 2,130 were retired during the calendar year 1915. The approximate cost of replacement of the 41,382 wooden cars is given at $528,787,100, on which the annual interest charge at five per cent would be $27,995,095. The charge to operating expenses under the classification of accounts of the Interstate Commerce Commission, assuming a value of $4,000 per vehicle replaced, would be $165,528,000.

The number of all-steel cars in service has increased from 629 in 1909 to 14,286 on January 1, 1916, an increase of 2,171 per cent, and the number of steel underframe cars has increased from 673 to 5,387, an increase of 800 per cent.

Figures are given also for 12 roads in Canada, showing that of a total of passenger train cars in service on December 31, 1915, 110 were all-steel, 550 steel underframe and 5,070 were wood.

ALL-STEEL TRAIN IN INDIA.—The Great Indian Peninsular Railway has recently put in service the first complete all-steel train in India. The train was built in England, shipped to India in parts and put together in the shops at Bombay.

Maintenance of Way Section

Trouble With High Embankments

Embankments over 50 ft. high, particularly when supported on soft ground as is frequently the condition in the case of bridge approaches, almost invariably give trouble during construction or later, because of undue settlement and slides. In old embankments the difficulty usually results from the formation of pockets of ballast from which the impounded water cannot escape because of the impervious surrounding material. In new fills the trouble arises either from the use of soft slippery filling or an overloading of the foundation. Occasionally in railway construction, material unsuitable for embankments has been wasted in considerable quantities, but this has usually been in cases where the excavation was in excess and more suitable material was readily available. In the construction of an embankment of nearly 2,000,000 cu. yd. as described on another page of this issue economic considerations demand that the cheapest material be used, and ordinarily there is little opportunity for a selection. The problem of providing a stable embankment must, therefore, be solved by other means. While not imperative from the standpoint of absolute safety, when considered from the standpoint of the ultimate cost, there is little question but that painstaking foundation investigations and studies of stability are as important as the preliminary work for a large bridge.

The Maintenance of Motor Cars

In the transition from the simple and rugged hand car to the more complicated gasolene motor car it has not always been realized that a new device such as the motor car may require special attention not given the old equipment and the revision to some extent of existing methods of maintenance. This has led to the cost of repairs of cars, reaching an excessive figure on some roads and has in some instances eliminated the economy which the motor cars would otherwise have shown. A motor car with its more complicated mechanism cannot be handled in the same manner as a hand car, but must be given more careful attention and its operator should be instructed regarding the manner of overcoming the difficulties most commonly encountered. Few men will question the economy of gasolene motor cars for maintenance of way forces today, but not every road has organized to operate and maintain the cars to secure the best results from them and the greatest economy from the standopint of maintenance and operation. When properly handled a motor car is simple to operate, but when it gets out of adjustment in the hands of an inexperienced man it is exceedingly complicated to him and his efforts to put it in running condition only serve to put it out of adjustment still further.

ACCURATE SCALE TESTING

A PAPER delivered before the convention of the National Association of Scale Experts, which we abstract on another page of this issue, discusses the relative value of long and short wheel base test cars in the testing of track scales, and points with no uncertain terms to the difficulty, not to say impossibility, of testing a scale properly with some of the test cars now in use. This paper is the result of research work under the auspices of the United States Bureau of Standards which has done much to improve methods and equipment for scale testing. While the railroads have realized the necessity for accurate scales and employ a corps of scale testers to secure them, they have failed rather generally to realize the necessity for scientific control of the work of testing. It must not be understood from this that the scale tester must necessarily be a technical graduate, nor that the railroad scale tester has not proved himself a skillful and valuable employee, but the testing of scales is fundamentally a matter of mathematics and if it is done by a man who does not appreciate the mathematical significance of his work, he is liable to go astray, unless his methods are carefully watched and his work occasionally checked by someone fully conversant with the principles of mechanics upon which the operations of scale testing are founded. The scale tester may be very skillful in his work, which he has been taught by long experience, but without scientific knowledge he may use methods which are inefficient and under some circumstances even inaccurate. In the paper referred to above, attention is called to the fact that with the long base double truck car the tester's efforts may be worthless, yet he himself is not in a position to understand the limitations of the apparatus placed at his disposal. Reports like the one mentioned above point the way for better scale testing, but in order to avail themselves of the results of the work done by the Bureau of Standards the railroad companies must place the scale testing in charge of one who is in a position to appreciate the value of these recommendations.

THE RAILWAY MAINTENANCE ENGINEER

AFTER this issue the contents of what has heretofore been the Maintenance of Way Section will be transferred from the *Railway Age Gazette,* in which this section has appeared in the third issue of each month for the last five years, to a separate monthly paper to be published by the Simmons-Boardman Publishing Company under the name of the *Railway Maintenance Engineer.* This change is made in order that we may serve more efficiently the officers and employees of the maintenance of way department of American railways. With a separate paper devoted exclusively to the maintenance of way department it will be possible to cover this broad field more thoroughly and to give to the reader a larger amount of information which will be of direct value to him.

The maintenance of way department with over 500,000 employees ranks second only to the transportation department in number of men. It spends annually over $400,000,000 for materials and labor. This department is now going through a marked transition from the rule of thumb methods of a few years ago to those of more accurate and scientific determination. If one is to keep abreast with these changes he must have access to complete information concerning them. It will be the aim of the *Railway Maintenance Engineer* to present accurate information concerning all the various activities embraced in this department which will aid the large number of officers and employees engaged in the maintenance of track and structures in their efforts to promote economy and efficiency.

This paper will discuss problems of organization, describe improvements in track work and materials, and in methods of handling bridge and building and water service work, present information concerning the latest developments in the field of wood preservation and discuss the maintenance

of scales and other facilities incident to railway operation. Special attention will be given to reporting in detail the proceedings of the conventions of the various associations in this field. The articles will be prepared from the standpoint of men in this department with the aim of interesting alike the chief engineer maintenance of way, the section foreman and intermediate officers.

One of the important features of the *Railway Maintenance Engineer* will be a complete news section, in which will appear a wide variety of information of interest to maintenance of way men concerning developments in the railway and railway supply fields, official appointments and promotions in both these fields, the construction of new and improved facilities, etc. The *Railway Maintenance Engineer* will be published at Chicago during the last week of each month.

LANDSCAPE GARDENING

THE principles of landscape gardening as applied to railroads and the methods pursued in their execution are described on another page of this issue. The propriety of expenditures for the architectural enhancement of railway structures has been repeatedly affirmed. Properly apportioned appropriations for landscape gardening are equally justifiable since the object is much the same and in many cases the efforts to beautify buildings are wasted in a large measure unless the surroundings received the proper treatment.

The first requisite is neatness which has a value from the standpoint of efficient management alone that is too well known to require demonstration. With neatness thoroughly established, attention should be directed to the utilization of the most suitable trees and plants available under given climatic conditions. The proper selection and arrangement of these is as much the special province of the landscape gardener as the correct proportioning of a building is the special task of the architect. The numerous examples of misdirected effort in the beautifying of both public and private grounds, demonstrate the need of the services of a specialist particularly on railroads since the work is so entirely unlike any other branch of maintenance engineering. Recognizing this, some roads have made the position of landscape gardener a permanent part of the maintenance organization. Others have secured excellent results by retaining the services of a landscape architect to plan new work for certain stations or important divisions. This policy receives justification from the fact that landscape plantings, according to the modern school, are composed of hardy annuals, which when once properly laid out will practically take care of themselves.

It is true that the services of an experienced gardener will prove valuable in the maintenance of landscape work, but in general the exercise of common sense will suffice. Occasionally it is necessary to curb the efforts of some talented though misguided subordinate who likes to trim trees and shrubs in fantastic forms.

As untidy conditions outside of the right of way line may almost entirely neutralize the best efforts at improvement by the railroad, it is necessary to obtain all possible co-operation from adjoining property owners. In suburban towns and at summer resorts and other places where people have come to realize the value of pleasing appearances, much has been gained by the united efforts of the railroad and the municipalities. Where the public is not in sympathy or even interested in the work, the railroads cannot accomplish much. The appreciation of beauty in nature on the part of the public, grows with the development from the younger to the older community and is a question of years. It is not surprising therefore that the western roads lag behind the eastern lines in this respect. Much has already been done and success lies in continuous co-operative effort directed along the proper lines.

HOLDING MEN

AS the spring work is now opening up rapidly a serious labor shortage is being felt very generally and a number of railways are already curtailing their programs of improvement work materially with the idea of opening up only such projects as they expect to be able to complete with the supply of labor in prospect. During every season of construction activity a shortage of labor is accompanied by an increased independence on the part of the men with a tendency to move from one location to another on slight pretext. At such times the problem of holding the men already in service is more important than that of securing new men, nearly all of whom come from other roads. Any measures which will hold such employees are, therefore, of special interest this year.

The most important measure tending to retain men in the service is attention to their physical comfort, particularly in providing an ample supply of wholesome food and clean and sanitary sleeping accommodations. It is common knowledge in construction work that certain contractors depend on the excellent reputations of their commissaries to keep their gangs full and that this has a greater influence on their supply of labor than the rate of wages. The same idea will apply with the railroads although all too generally it has not been realized in the past. Boarding concessions are commonly let to contractors who, in the absence of competition, frequently serve as poor food as the men will stand regardless of the relation its cost bears to the price charged the men. In a similar manner sleeping quarters are provided in cars that are poorly maintained and unfit for labor use.

These conditions are not necessary to railway work. In practically all cases a sufficient amount is deducted from the pay of the men to entitle them to proper food and the railroads owe it to the men to see that they receive such food, either by operating the commissaries directly or by installing sufficient supervision to see that the contractors give good service. Likewise, while it is not necessary that the cars be of recent design or provided with strong draft gear it is important that they do not leak and that they are maintained in a sanitary condition.

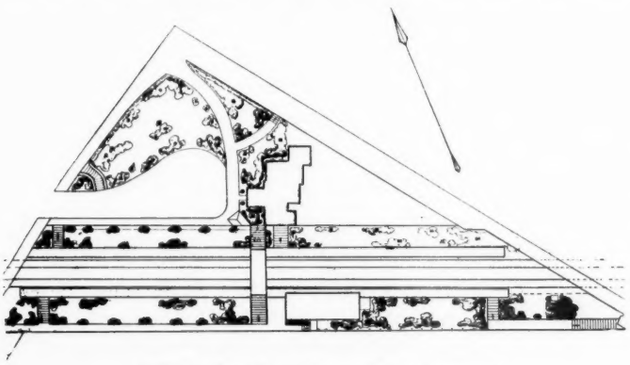
The poor quality of the food and particularly the unsanitary condition of the cars has done much to drive the better class of labor out of railway work. As outlined briefly in another column, the National Americanization Committee has undertaken a most commendable work in endeavoring to secure designs for sanitary living quarters for men employed in railway construction and maintenance of way gangs and has offered several prizes for such designs. Entirely aside from the plans secured, this competition will call attention to this phase of railway work.

The difficulty in holding men is not, however, entirely one of board and lodging. A few roads have gone even further and have secured excellent results by installing a few simple conveniences as papers and games for their men. One road has set aside a lounging room or car in one of its camps in which the men may congregate in their leisure hours. Anyone who has noticed the eagerness with which the English-speaking laborers in track gangs solicit newspapers from passing trains will appreciate the favorable results following the expenditure of a few cents daily to place such papers in these gangs regularly. The expense involved in the installation of such simple measures will secure much greater results in a season such as this than an increase in wages which only results in drawing men from adjoining railroads and if universally followed, results in benefiting no one.

Scientific Landscape Gardening on Railroads

The Organization and Administration of the Work and a Discussion of the Principles Governing Its Practice

Landscape gardening in some form has been practised on railroads for many years, but only on a limited number of roads is the work on a thoroughly organized basis. On the majority it is left largely to the zeal of the track foreman, supplemented by such interest and ingenuity as may be displayed by the station agent or the roadmaster. Landscape gardeners have been employed by some of the western roads, but on the whole the most systematic work is being carried on in the east, where the earliest work of this kind was done,



A Plan for Landscape Development

the Central of New Jersey claiming the distinction of being the pioneer in gardening on railroads.

Sporadic efforts at the beautifying of station grounds outside of a general neatness, or an attempt to maintain a lawn, have generally drifted in the direction of flower beds, success depending very largely upon the personal interest taken by the section foreman and the agent. Dampening of the ardor of the interested individuals has generally resulted in allowing the beds to become neglected, or in causing them to be

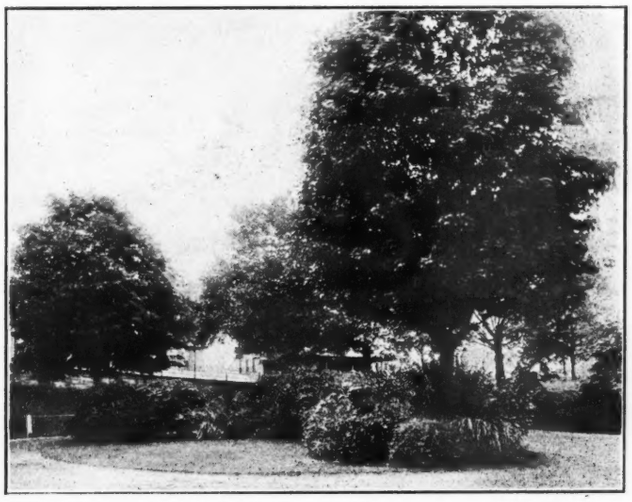
An Appropriate Landscape Treatment for a Small Station

abandoned entirely. Better organized efforts with a definite appropriation, and perhaps under the direction of a gardener, have broadened the scope of the work to include hedges, trees and shrubbery, with more attention to the proper maintenance of the lawns and definite provision for the care of the plants during the winter months.

Realizing that much effort was being misdirected and that landscaping is as much in need of expert supervision as the design of buildings, some railroads engaged trained landscape architects to plan their work. The Boston & Albany probably deserves the distinction of being first to recognize the existence of landscape art. It employed the American landscape architect, Olmsted. A decade ago the Philadelphia, Baltimore & Washington engaged similar service, and the appropriateness of the station areas arranged under its plans is the basis for the belief that it is the most attractive on the Pennsylvania Railroad.

The principles of landscape gardening, like those of architecture, are not easily explained in a few words. In general they involve the exercise of a sense of fitness or propriety, rather than the blind application or adaptation of the conventional. The principles governing landscape gardening, as applied to railroads, are outlined in an article on following pages by I. T. Worthley, assistant forester, Pennsylvania Railroad.

Conduct of the work according to the modern school of landscape gardening is not only fruitful of more artistic and appropriate results, but these results are obtained at a rela-



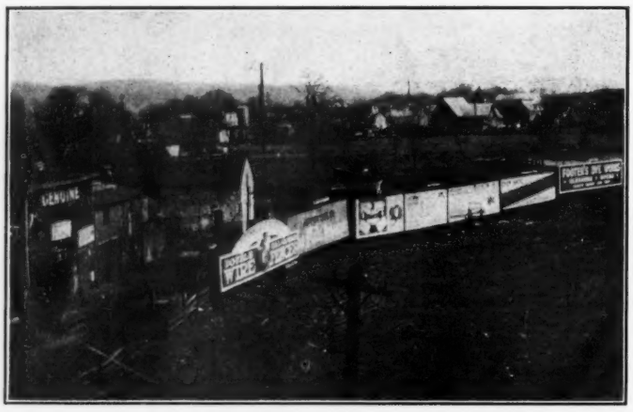
A Pleasing Landscape Treatment Along a Station Driveway

tively smaller cost. Less use is made of flower beds, which require much attention during the season and complete renewal each spring not only on account of the cost, but because they are not indispensable to the desired results. Except where barriers, boundaries or screens need emphasis, formal hedges are discouraged, and thus the labor of trimming them is saved. Instead, extensive use is made of trees, both deciduous and coniferous, and shrubs of many kinds, carefully arranged to produce natural effects. Development of this kind needs little attention, once it has been planted.

Landscape Work on the Pennsylvania Railroad

On the Pennsylvania Railroad gardening has been practised since the sixties. For a long time this work has been carried out under the direction of division gardeners with general supervision by the maintenance officers and the division superintendents, the work as carried on being largely an attempted expression of ideas of the gardener or of his superior officers. The track forces are called upon to furnish most of the labor necessary. During the last three years this work has been under the general direction of the forester, although retaining the division organization, and the ideas of the modern landscape architect are gradually being introduced.

Shrubs, trees and herbaceous plants required for this work are grown in a nursery near Morrisville, Pa., under the direction of the forester's office. This nursery was started in 1908 on a farm purchased in connection with some construction work on the low-grade freight line. About 50 acres of this farm were first used for the purpose of nursing tree seedlings for forest planting. As the acreage of land available for this use was reduced, it has been possible to devote more and more of the nursery to plants for landscape uses.



Slovenly Neighbors and Billboards

A large variety of trees and shrubs is grown for this purpose, the age at which they are ready for use depending upon the species and the size desired; in general, a considerably longer time than is required to prepare trees for use on forest lands. Coniferous trees for landscaping use require at least six years' growth. Broad-leaf trees, particularly when used as individuals, must be somewhat older.

Authority for improvements at a given station or other point along the line calls for a careful study of the local situation, with particular attention to the direction from which the development is to be viewed. Ordinarily the view from the track is the most important, although in cases where there is a considerable local passenger business the approach from the street to the station must also receive attention. The character of the view beyond the station grounds determines the need of screen planting; or, on the other hand, the desirability of avoiding obstruction. The necessity of a clear view for enginemen at all places and for the public at highway crossings must always be observed. Another important item for consideration is the adaptability of the plants for the particular site. For instance, the evergreens will not do well in places subject to much coal smoke.

After the design has been determined upon, a plan is made showing the approximate location of all individual plants and the beds or banks of the smaller ones. With the help of this plan a bill of material is prepared, from which the plants are shipped, after having been fumigated in conformity with state laws. The planting is done by the division gardener in accordance with the plan sent to him, under the general oversight of the office of the forester.

After the planting is completed, the maintenance is the province of the division gardener, except for inspections by the forester or his assistants, and in cases of disease, insects or other trouble, when there is a demand for all the expert knowledge available. The landscape gardening of the Pennsylvania Railroad is under the general direction of John Foley, forester, and I. T. Worthley, assistant forester.

Gardening on the Philadelphia & Reading

On the Philadelphia & Reading the work is under the direction of the chief gardener, who has a permanent force of three gardeners to assist him. All other labor is furnished by the track organization. The work is conducted with little expense for material, as a small nursery at Trenton Junction and a greenhouse in Philadelphia near the Wayne Junction station, which are operated by the gardener's force, supply practically all the plants necessary.

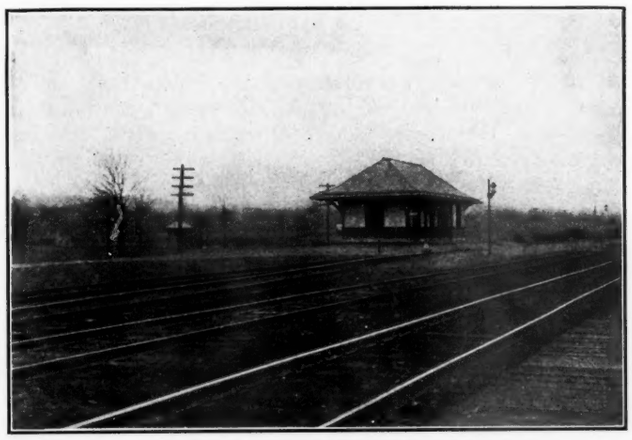
In addition to trees, shrubbery and hedges considerable use is made on the Reading of beds of flowers and ornamental foliage plants, the beauty of which has long received the approbation of the patrons of that road. Considerable use is also being made of small conifers grouped in beds. The great variety of shades available in these offer opportunity for the production of pleasing effects with the advantage that they are perennial, and the maintenance cost is low. About 24,000 of these small evergreens are now in root in the nursery at Trenton Junction, which is located near the station, and adds much to the appearance of the station grounds. Hedges of privet are also used extensively to mark right of way lines, driveways, etc.

Screening and Beautifying a Station Driveway

Flower beds are maintained at about 150 stations and involve the planting of about 150,000 plants each year. As a considerable portion of the work which this involves consists in the preparation of the plants in the greenhouses during the winter months, it is possible to keep the working force employed the year around. Late in October all plants —such as geraniums—which are grown from cuttings are pulled up and sent to the greenhouse, where they are cut up

into slips. These are then planted in beds of clean, moist sand, where they remain a sufficient length of time to form roots. They are then transferred to small pots, and later large ones. This work occupies all of the winter months, until the time for planting in the spring.

The planting season is a busy time and occupies five weeks, beginning about May 10. The plants are delivered to the stations on one division at a time. A baggage car



Neat but Barren Surroundings at a Small Depot

handled in a special train is loaded with the plants packed in separate boxes for each bed and station. All the work on the Philadelphia & Reading is under the direction of Paul Huebner, chief gardener.

A FEW APPLICATIONS OF THE PRINCIPLES OF RAILWAY LANDSCAPE GARDENING

By I. T. Worthley,

Assistant Forester, Pennsylvania Railroad, Philadelphia, Pa.

It is fair to assume that a majority of railroad passengers are sufficiently intelligent to appreciate beautiful surroundings. Very few of us become so engrossed in ourselves or our affairs that we will not willingly look away from our reading while traveling to relieve our overtaxed eyes and minds with a view of a beautiful building or a stretch of restful green lawn framed by shrubs and trees. Opportunities to indulge in this pleasure have become fewer each year, with increased industrial development along railways, both in cities and outside them. Farther away, in scantily-peopled regions, the forests have given way to funereal stump-lands or to gaping quarries, while sunny, thriving farms are often disfigured by inartistic billboards.

Slight as are the grounds for congratulation, it may safely be said that railroads have contributed more to beauty than have their industrial neighbors. Neatness is one of the elements of beauty, and in the mind of the maintenance man it is subordinate only to safety and efficiency. Only a small fraction of the bordering property can compare in neatness with the right-of-way along any of our progressive railroads.

The business of transportation has grown quite as rapidly as any other, and often ill-spared has been the time and money spent by railroads simply on neatness. Here and there their neighbors are awakening to a knowledge of the virtue of cleanliness and order.

Following their instinct for neatness track men sometimes go to an unfortunate extreme "cleaning up" the right-of-way; they remove unobjectionable trees, shrubs, rocks, irregularities in the surface of the ground and other natural features which are highly prized by the landscape gardener, and turn over to him the resulting barren, uninteresting land surface to be beautified. It would be much more rational to take the landscape man into consultation while the plans for right-of-way improvements are being made. The location of buildings, the utilization of open areas and the planning of roads and paths for both the greatest convenience and most attractive appearance, and the economical use of rich and poor soil in grading, all are problems whose complete solution requires the co-operation of the civil engineer and the landscape designer.

It is now the policy of our railroads to afford their patrons the surest safety, the speediest travel, and the greatest comfort that available resources will afford. This ideal of service is not completely realized by safety, speed, a smooth track, and comfortable cars; the passengers must be mentally at ease. Perhaps the first large effort to obtain this result was to replace the gaudy, excitable interior decorations of "palace" cars with quiet, restful tints of green and brown. The logical subsequent step should be to lessen the strain resulting from the constantly changing foci and scenes from the windows of a moving car.

Billboards and posters usually succeed in their efforts to cause a quick concentration of the traveler's thoughts and are profitable to the advertising companies. Against these

Tree Butchering

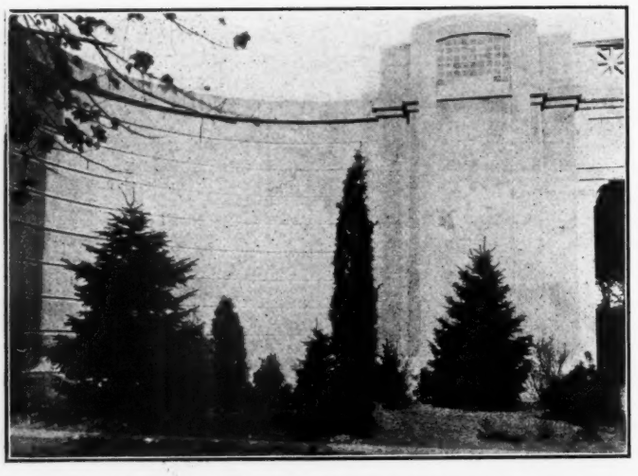
benefits to a very few people stands the pleasure marred by more than a billion travelers annually throughout our country. Some railroads refuse to encourage posters and are opposed to placarding the country with billboards. Railway gardeners can hide advertising signs in many instances by planting tall-growing trees as close to the track as operating conditions will permit. Such a planting need not be tiresome to the traveler, since an underplanting of large masses of shrubs or a tall privet hedge would hide the tree-trunks and present a solid wall of green.

Beds of fancy design and tender plants placed in the most conspicuous places, such as the centers of lawns, have long been the hobby of the gardeners of the old school of landscape decoration. These beds have the sole argument of prettiness, which soon become tiresome. The flowering and foliage season of annuals and perennials is short; when this is past, the bedraggled beds are depressing. They require an inordinate amount of culture and consequent expense. Another class of gardening excrescences is composed of the jagged, shapeless beds set in most unlikely situations as a

result of some misguided gardener's effort to avoid formal beds and to be natural.

With plants, as with our population, exotics are changing into natives constantly; we do not exclude foreigners from our society simply because they are new to us, neither should our back-to-nature enthusiasts taboo a Lombardy poplar from native American surroundings because it was born in Italy. Nor should we go to the other extreme, as many have done, and cover our world with blue spruce because they are not green.

While we have standardized most forms of equipment and operation, it does not follow that we should insist upon standardizing our surroundings. In railway gardening we should build and plant ruggedly in rugged regions, and delicately in cultivated surroundings. Ruggedness implies strength, but not crudeness; the best-wrought iron work usually has a rough finish, because its value lies in strong design and not in the surface, while perfection in jewelry requires faultlessness in both design and finish. Similarly in gardening we should not clip and "shape" the plants around our country stations, though such symmetry may be



An Architectural Planting Along a Subway Abutment

quite appropriate in the vicinity of terminals or other architecturally-refined buildings. Even an architectural setting, however, does not always demand formal planting; a strictly informal grouping may be the most interesting treatment possible.

Whenever the traffic moves rapidly the plantations should be large and of but few kinds of plants, for we cannot see the beautiful blush of the most perfect rose while passing it at a speed of 60 miles an hour. Not infrequently otherwise attractive scenes are disfigured by bungling or ignorant workmen. Trees may be butchered by careless pruning. Plants used to produce a natural effect are trimmed into balls. Finished pictures are "touched up" to their destruction. Plant hobbies are carried to tiresome extremes. Vines which are substituted for grass, in order to save the cost of mowing the latter, receive no attention whatever. In these and many other instances "good things go bad" as viewed by the landscape man.

A large portion of the season when plants are in leaf and flower is sunny and hot. Then nothing is more welcome than shade and shadows. It may fairly be said that trees are of first importance in planting, because their shade is so necessary to comfort and their shadows are so important a part of the final picture. To a lesser extent the shadows of shrubs, when placed advisedly, afford a similar satisfaction. Further, shadows offer a more effective background for a display of color than can be obtained by any sort of foliage.

There exists a very definite public craving for beautiful surroundings which must be satisfied in a lasting, practical way and under many restrictions of expense and traffic requirements. Hobbies and notions have no place in this work, nor has narrowness of conception. The railway-landscape problem is not of a hundred-acre estate in one place—it is of the whole country with its wonderful variety of climate, soil, flora and history as displayed daily by the railroads to receptive minds of millions of passengers for their cheer and education.

HOUSING TRACK LABORERS

The National Americanization Committee, 18 W. 34th street, New York, has inaugurated a competition on the housing of track and construction laborers employed in railway work. In its announcement of this contest, the committee states that the need of securing adequate sanitary living quarters for men employed in railroad construction and maintenance of way work at points where their location must be temporary and where no permanent quarters are available has long been critical. Increased attention to the adequate housing of these workers is one important means of conserving our supply of unskilled labor. Men who have lived for six months in a construction camp where an old box car crowded to the roof has been the only dwelling, where plumbing, drainage, and sanitary conveniences are unknown, are in no state to face a hard winter in city factories and foundries. Moreover many of these men are immigrants and the camp standard of living is often the first standard met in America. If the conditions of the camp are bad, as unless especial care is taken they must be, the foreign-born workmen do not learn American standards there which are essential in American communities. Through the present competition the Committee hopes to produce the best and most practical ideas and plans for the housing of these construction gangs in ways that will at once conserve the energies of the men and promote an American standard of living. The object of this competition is to secure a satisfactory substitute for the freight car now used to house the construction gangs.

Contributors to this contest are required to submit four drawings; a plan of the situation arrangement, a floor plan of each car, a longitudinal section of each car and an individual transverse section. Drawings must be made on white paper or cardboard or on white tracing paper mounted on cardboard and may be drawn in pencil or ink. Each competitor is allowed to present a brief explanatory statement setting forth such details of the arrangement and construction as cannot be supplied from the drawings. All contributions must be in the hands of the committee before 12 o'clock noon, June 1.

It is stated that the proposed camp car outfit should permit of flexibility with regard to the number of men to be accommodated both with sleeping and eating facilities. It is assumed that a site for a camp, a spur track on which the camp may be located, an adequate supply of water and old passenger coaches are available. The competitors in this contest will proceed from this point to design the complete camp.

Involving as this does one of the most important problems with which the railways are confronted today, the results will be watched with much interest. The committee hopes to enlist the support of railway men in preparing designs for this competition.

ONE OF THE JOYS OF RAILROADING IN INDIA.—Not long ago a herd of wild elephants took possession of the short branch line between Latiguri and Ramshahi, in the Bengal Duars. The engineman of a train managed to frighten off most of them; one elephant, however, charged the engine and damaged it slightly, but was itself thrown off the line with, it is believed, a broken leg.

Handling Practical Bridge Construction Work

Five Interesting Methods of Solving Special Problems Encountered in Routine Maintenance of Way Work

The five papers published below were received in the contest on Bridge Construction Methods, which closed several months ago. They describe the manner in which five interesting problems were solved by simple although instructive methods.

ERECTING A TRUSS BRIDGE WITH A LOCOMOTIVE CRANE

By C. M. McVay

Engineer Maintenance of Way, Kanawha & Michigan, Charleston, W. Va.

Several months ago it became necessary to renew the bridge over Gauley river at Gauley Bridge, W. Va., at the southern terminus of the Kanawha & Michigan, on the connection with the tracks of the Chesapeake & Ohio on the opposite side of the river. The bridge to be renewed had been designed for Cooper's E-30 loading and was erected about 1894. It consisted of three 168-ft. pin connected through truss spans and two 56-ft. deck plate girder spans, one at each end of the structure. As the piers and abutments were found to be in excellent condition it was decided to renew the bridge with three 168-ft. through riveted truss and two 56-ft. deck plate girder spans designed for Cooper's E-60 loading. In order to carry the heavier loading on the piers and abutments, the old 18-in. copings were removed and a 12-in. I-beam grillage substituted, which was filled with concrete at the completion of the bridge erection. The bridge was then designed with its base of rail only 1½ in. higher than that on the old structure.

As it was necessary to carry traffic over the bridge during construction, soundings were taken in the river and falsework ordered accordingly, the work being started on July 1, when the danger of high water in the stream is practically past. It was decided to handle the erection of the new trusses and the dismantling of the old ones with a Brown hoist locomotive crane which was in service at Charleston, W. Va., in coaling locomotives. This machine weighed 104,300 lb., had a boom 35 ft. long and could handle a load of 12 to 14 tons without difficulty. The only change necessary was to remove the clamshell bucket and apply a lifting hook. While waiting for the arrival of the falsework material, which had been shipped from the Pacific coast, the locomotive crane unloaded the new steel members from cars to storage piles near the site and the 56-ft. girders were erected on temporary bents parallel to the old spans, and completely riveted. As these spans erected complete were too heavy to be handled with a locomotive crane, two 100-ton cranes with a work train were brought in for this operation.

When the falsework arrived it was erected in the river by the locomotive crane. The bed of the river is solid rock, about 36 ft. below the base of rail with about 6 ft. of water under the south span. As the bed is the lowest under this span the falsework was first erected there. The old truss in this span was then dismantled by the locomotive crane, the material being loaded into gondola cars as removed. After the truss had been taken down the old floor system was picked up by the machine and loaded on cars at the rear as the machine could turn a complete circle. The floor system of the new span was then placed in the same manner. In the erection of the new truss the members were placed in the order needed on a flat car in front of the machine, the verticals and diagonals on each side being placed first, starting at the center and working both ways, after which the end batter posts were placed and then the top lateral system.

When the new truss in the south span had been completely erected and bolted, the crane placed the falsework under the center span, leaving that under the south span until the riveting gang had finished. The erection of the center span was carried on in the same manner as that of the south span, after which the falsework in the south span was tied together and knocked over in the river. It was then pulled over under the north span and erected there, a small amount being cut off of each stick to adjust it to the proper height. After the erection of this span and the riveting of the center span the falsework under the latter was tied together and knocked over in the river, then pulled to the shore where it was loaded by the crane working on the girder span at the end of the bridge. The machine was returned to Charleston for coal loading until the riveting in the north span had been completed, after which it was brought back to load the falsework from under that span in the same manner as described above. The old deck girders were then picked up and loaded by the machine.

This locomotive crane did all switching and car handling

Locomotive Crane Erecting End Post of 168-Ft Truss Span

necessary, clearing the bridge for about four movements each way during the 10-hour working day. As there is a yard at each end of the bridge there was no difficulty in finding track room for switching. The heaviest load handled by the crane was 12 tons, which was the weight of one of the 56-ft. deck girders. The heaviest truss member handled was 9 tons, this being the double section top chord piece in the center of each truss. The cost of the job, including all labor and material, except the bridge steel, was $0.0055 per lb. erected. This figure includes the cost of new ties and guard rails. About 90,000 rivets were driven in the new bridge. The locomotive crane worked 53 days, and it is estimated that it placed about 35 per cent more steel per day than would have been possible with a traveler.

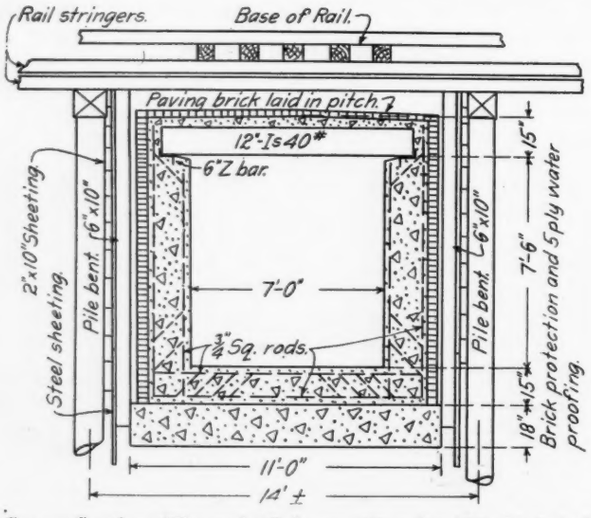
The new girders and trusses were designed and fabricated by the Mt. Vernon Bridge Company, and the erection was handled by company forces under the direction of the writer and Paul Eberst, foreman of bridges and buildings.

PEDESTRIAN SUBWAY IN QUICKSAND

By C. V. Chamberlin

Assistant Supervisor of Bridges, New York Central, Utica, N. Y.

In the construction of a reinforced concrete pedestrian subway under the four main tracks of the New York Central at James street, Oneida, N. Y., unusual provisions had to be taken in the excavation, sheeting and waterproofing of the subway on account of the quicksand and water bearing soil which are encountered in this locality. As shown in the accompanying sketch, the falsework bents were driven 14 ft. center to center, allowing just enough room between the bents and the subway walls for the sheeting and the bracing. Two-inch hemlock sheeting nailed to the piles was used at first, the first set of cross bracing being placed low enough to support the plank runways on which the excavation was wheeled out. Sand and water were encountered at a depth of 8 ft. but the real quicksand lay below another stratum of clay which was cut through about 10 or 11 ft. below the base of rail. At a depth of 11 ft. it was necessary to drive Lackawanna steel sheeting in advance of the excavation, 4-ft. lengths being driven by hand. The water had at first been handled by two diaphragm hand pumps and later a small centrifugal motor driven pump was installed. After driving the steel sheeting the water was drained down through the center to one side which greatly facilitated the excavation as the sand was very compact and easily excavated if kept free from water.



Cross Section Through Subway Showing Methods of Construction

In adjusting the bracing to allow the placing of the walls and roof, it was necessary to exercise some ingenuity as the falsework piles had driven somewhat irregularly and left scant leeway in places between the sheeting and the wall proper. Vertical studs of 6-in. by 10-in. timber were set about every 10 ft. with their bases anchored in the foundation course of concrete and their tops braced by 6-in by 10-in. struts, placed high enough to clear the roof of the subway. The outer protection course of brick and the waterproofing were placed before concreting the walls. The forms were built against the 6-in. by 10-in. studding, the bricks laid up against the forms and held by 20-D nails. The vibration caused by passing trains did not produce any perceptible jar in these bricks. The standard New York Central 5-ply waterproofing was applied to the foundation and sides. By leaving a slight space between the foundation and the falsework piles the water was readily drained down the sides to the pumps and the floor kept dry for the waterproofing. During the placing of the reinforcing rods and the concrete it was necessary to keep the pumps running steadily so the water would not work under the waterproofing and as freezing weather had set in the whole subway was planked over and stoves set up inside. The stairways were covered with tarpaulins. The concrete was wheeled and dumped from above through small chutes boxed into the plank coverings.

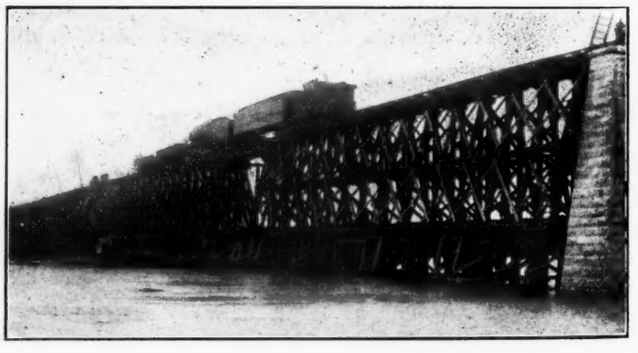
As it was important to transmit the loads from the roof directly to the center of the sidewalls, the plans called for 6-in by 6-in. Z-bars to be embedded in the concrete under the ends of the 12-in. I-beams in the roof. These Z-bars were set in the center of the walls with the web flat and the concrete battered off 1½ in. from the inner edge of the steel to the face of the wall. It was found necessary to build the wall up to level of the face of the Z-bar and after it had hardened and the Z-bars had been set, to slope off the concrete as required. The roof was concreted and waterproofed during two or three warm days. Since the completion of the subway only one insignificant leak has developed although the water stands 6 ft. deep on each side. This work was done by company forces under the direction of E. L. Jenkins, supervisor of bridges.

ERECTING GIRDER SPANS BY FLOATING ON BARGES

By S. C. Tanner

Master Carpenter, Baltimore & Ohio, Baltimore, Md.

In two recent instances we have found it expedient to erect plate girder spans by end launching, supporting the outer end on a barge. In the first case a temporary trestle was being built across the Big Miami river near Lawrenceburg, Ind., following the destruction of two spans of a through truss bridge and the pier between these spans in the flood of the spring of 1913. The opening left by the flood was 414 ft. long and the base of rail was 48 to 64 ft. above the bed of the river. Piling was driven with floating equipment and 30-ft. framed bents placed on the pile bents as shown in the accompanying illustration. At the pier location it was desired to maintain a 50-ft. opening to allow for the reconstruction of the pier. This space was to be spanned by a pair of 55-ft. deck plate girders. No crane was available for the erection of this girder span and the floating equipment was insufficient for the work. Plans were therefore made to use a 30-ft. by 50-ft. barge which was at hand. The barge was floated into the opening in the trestle and while a small force of men placed a three-leg bent on the barge and constructed a light track across the bent connecting the ends of the trestle, another force placed the girders on the track about one-half mile away with a skid under each end. These skids were made of 8-in. by 16-in. timbers 8 ft. long with an angle bar spiked to the under side of the timber to serve as a shoe to slide on the rail and hold the skid on the track. When all was ready a gondola car was



Temporary Trestle on the B. & O. Replacing Washed Out Truss Spans, Showing Girders Over Pier Location with a Barge and Three-Leg Bent Used in the Erection of This Span

placed against the back end of the girders and a locomotive pushed them down the track and around a 9-deg. curve to the newly constructed trestle. This movement was continued until the girder span had reached its position over the break in the trestle. After the engine and car had been removed the girders were jacked up from the trestle, the temporary track and three-leg bent removed and the girders lowered into place. The photograph was taken as the first train passed over the bridge after it was opened for traffic but the barge can still be seen in the opening and also the three-leg bent used to carry the girders.

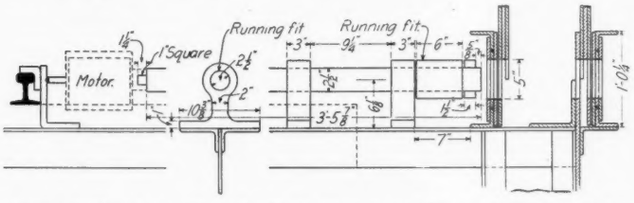
In the erection of another structure over a canal it was impossible to build falsework on account of the canal traffic and as no bridge crane was available to handle the 66-ft. girder span it was assembled on the track on skids and pulled out over the abutment nearly to the point of overbalancing and then floated across to the other abutment by blocking up under the outer end on a canal barge. The movement was effected by a hoisting engine.

REPLACING BOTTOM CHORD PINS IN A TRUSS BRIDGE

By E. K. Barrett

Supervisor Bridges and Buildings and Water Service, Florida East Coast, St. Augustine, Fla.

We recently had occasion to replace four bottom chord end pins in a truss drawbridge, in which the pins had become pitted around the pin holes. The old 4½-in. pins were removed, the holes bored out and new 5-in. pins placed without taking the bridge out of service at any time by the arrangement illustrated in the accompanying drawing. The boring bar, after passing through the members on the inside of the chord, was followed by a bushing of the same size as the pin. The boring bar could then pass through this bushing to cut out the other side of the chord.



Method Used on Florida East Coast, to Bore Out Pin Holes in a Truss Bridge and Renew the Pins, Without Taking the Bridge Out of Service

SKIDDING A PILE DRIVER ON THE MAIN LINE

By W. L. Ratliff

Supervisor Bridges and Buildings, Illinois Central, McComb, Miss.

In the construction of a second track on the Louisiana division of the Illinois Central it was necessary to drive a large number of piles for small bridges in the swamps, there being as many as 12 to the mile in many cases. It was found that these piles could be driven quickly and cheaply by a creeping pile driver, the base of which was 45 ft. by 10 ft. with 50-ft. pendulum leads. It was intended to move this driver from one opening to the next along the new embankment by skidding it on cross timbers. It was found, however, that it was very expensive to move it in this way as the embankment was very soft and the timber would not stay in place, making it necessary to lower the leads to prevent overturning the driver.

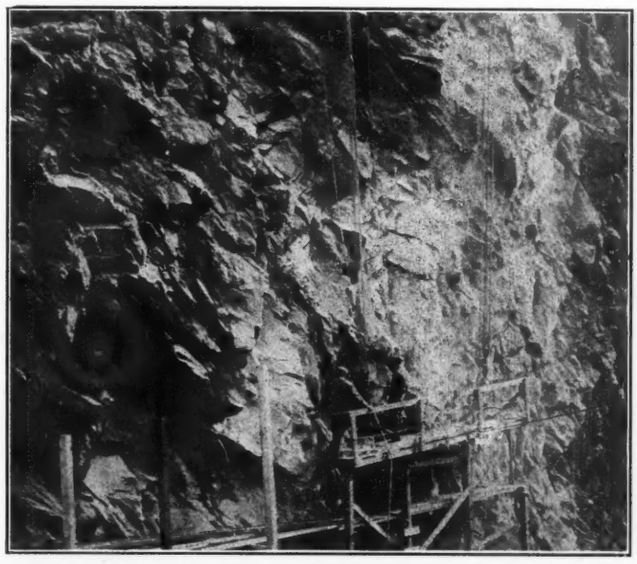
The writer, who was in charge of the work at the time, developed a method by which the driver could be skidded on the old track. Two skids were made of pieces of 7-in. by 16-in. timbers 14 ft. long using 1½-in. iron pins as guides or flanges to keep the skids in place on the rails and plates to reduce the friction. The driver was pulled over onto the track with a hammer line run out 200 or 300 ft. and by the use of a little black oil on the rail could be pulled along the track 600 to 800 ft. in from 15 to 20 minutes. Even though traffic was heavy it was rarely ever necessary to stop a train as special efforts were always made to get a lineup from the despatcher. The cost of driving piles on this work was $0.03 per lin. ft. including the unloading and handling of all piles, while contract work at the same time was costing $0.10 to $0.12 per ft.

COVERING A ROCK CUT WITH GUNITE

By N. W. McCallum

Supervisor of Structures, New York Central, New York, N. Y.

The Spuyten Duyvil cut on the New York Central, about 10 miles north of New York City, was for a long time a source of considerable concern because of the disintegration of the steep rock sides, and about two years ago it became necessary to take measures to remedy conditions. The cut is about 500 ft. long, 80 ft. high on one side, and about 50 ft. high on the other side. The four-track railroad narrows to two tracks through the cut. On account of the traffic conditions, limited clearance, and the addition of the third-rail for electric operation a few years ago it was practically impossible to strip the weathered rock from the sides of the cut without roofing over the tracks to protect trains. To do this would have been so expensive that the larger question of more permanent protection presented itself. Three methods were considered: (1) A temporary roof to permit the sloping back of the rock to a flatter angle; (2) a permanent roof, consisting of I-beams supported on steel columns and head girders; (3) the use of the cement gun for the protection of the existing face and for filling crevices in the rock to prevent further action of frost. The first two were costly, and in view of possible changes of alinement of the railroad in this vicinity, they were rejected in favor of the cement gun process. A final decision was not made, however, until a portion of the cut had been treated and was judged satisfactory.



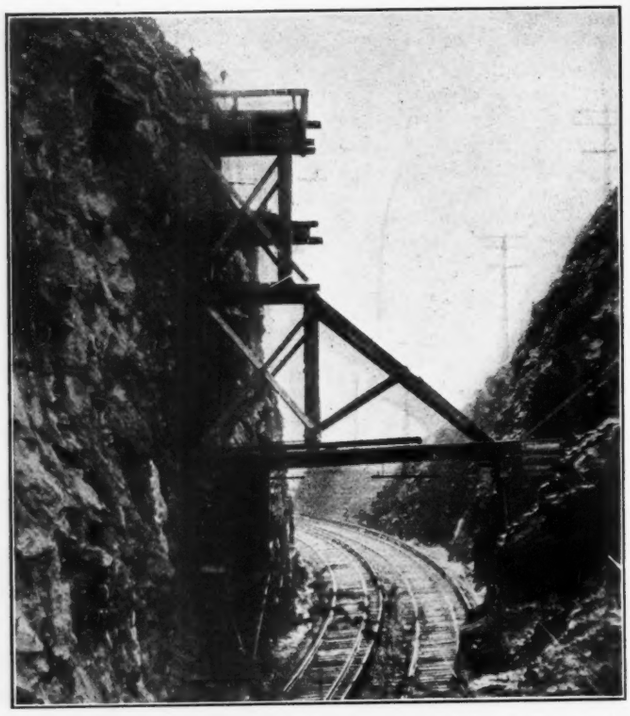
Scaffold for Cleaning and Covering the Face of the Rock Cut

A compressor plant of three motor-driven air pumps with a capacity of 75 cu. ft. of air per minute each was set up at one end of the cut. The motors were 600-volt d. c., and were run from the third-rail current. The compressors were arranged for automatic control. Ordinarily only two were needed for running the rock drills, but all three were put in service for the use of the cement gun. This was set up in

the middle of the cut alongside the southbound track, where there was sufficient space for the apparatus and about one carload of sand.

A hanging scaffold was hung by lines with three-sheave blocks from cableways running from one side of the cut to the other at the top. This staging was 20 ft. long, and strong enough to carry the weight of four men and about ½ cu. yd. of rock. The face of the rock for the length of the scaffold was thoroughly cleaned by air in the crevices, and all small loose rock and dirt were removed. The rock was put on the scaffold, and then lowered to the tracks, where it was removed later by a work train. At the same time the portion of the rock face covered by the scaffold was carefully inspected and the exact work necessary decided upon.

From the start it was evident that any facing treatment of this character would have to be combined with a system of steel anchors to hold it on. Much of the rock was overhanging, and it was often necessary to build up a bench with the cement gun from a point 10 to 20 ft. below the rock to be



Falsework to Support a Mass of Rock While It Was Being Removed

supported, to get a proper footing. In preparation for these benches anchor holes were drilled into the rock and one 1-in. round anchor bolt was placed in every 5 to 10 sq. ft. of area. These holes were drilled through any doubtful rock until well into the rock beyond; and many of these anchor holes were drilled from 5 to 6 ft. deep. This drilling was all done by air, with common hand hammer drills weighing about 35 lb.

The benches built up with the cement gun were carried for the full thickness and showed no tendency to slide or slough off. The mixture used was 1 part cement to 2½ parts of sand. This was changed to 1 to 3, with the further addition of one-man stone when forming the benches mentioned above. Drip pipes were inserted as the work progressed. It was found possible to hold up all the rock face by this method, except one overhanging cluster of about 30 cu. yd. A timber tower spanning both tracks was built to support this mass while it was being removed by a derrick erected on top of the cut.

The work on this cut was started in September, 1914, and carried on through the winter and completed in September, 1915. The winter of 1914-1915 in the vicinity of New York was mild, and it was possible to get five or six days a month when the cement gun could be used without danger of freezing the gunite. The rest of the time was spent drilling and stripping the rock. The gang consisted of from 8

Views of the Rock Before and After Treatment

to 10 men. About 8,000 lin. ft. of anchor holes were drilled, and about 10,000 lin. ft. of steel rods were used for anchors. All of this facing has passed through one complete winter, and part of it through two winters. There are no signs of cracking or disintegration, and there is no present indication that the work is not absolutely permanent in character.

ABSTRACT OF ENGINEERING ARTICLES

The following articles of special interest to engineers and maintenance of way men to which readers of this section may wish to refer have appeared in the *Railway Age Gazette* since March 17, 1916.

Lackawanna Improvements at South Orange.—In connection with grade separation and third track work on the Morris and Essex division, new passenger stations were built at South Orange avenue and Mountain station, South Orange, N. J. Interesting features involved in the design and construction of this work were described by A. B. Cohen, concrete engineer, Delaware, Lackawanna & Western, in an illustrated article in the issue of March 24, page 683.

An Interesting Track Elevation Project.—Further progress is being made in track elevation in the city of Chicago on 4½ miles of line owned by the Chicago, Milwaukee & St. Paul and used by the Northwestern Elevated. The physical conditions of this work and the construction methods employed were described in an illustrated article in the issue of March 31, page 755. An editorial comment on this work with special reference to construction by company forces appeared on page 733 of the same issue.

Rail Prices and the Steel Market.—The basic prices for Bessemer and open hearth rails have remained at $28 and $30 respectively as heretofore, in spite of the unusual rise in the prices of other steel commodities. The advantages of the fixed prices were discussed in editorials in the issues of April 7, page 775, and April 14, page 826.

Disastrous Floods in Southern California.—Heavy damage was inflicted to property in Southern California during two storms of unusual severity occurring about nine days apart during the month of January. The effects on railway transportation and the measures taken to restore traffic were described in an illustrated article in the issue of April 7, page 790.

Reconstruction of Denver Union Station.—Extensive alterations and improvements have been under way on the Union Station at Denver since September, 1914, involving a total expenditure of nearly $4,000,000. The details of this project were described in an illustrated article in the issue of April 7, page 795.

New Lehigh Valley Roundhouse at Sayre, Pa.—The Lehigh Valley has recently completed a 46-stall reinforced concrete roundhouse at Sayre, Pa., to replace an old structure. The construction of this house, together with the extensive rearrangements of other terminal facilities, was described in an illustrated article in the issue of April 14, page 841,

A New Cut-off on the Norfolk & Western.—This road has recently completed a 37-mile low grade cut-off to provide improved facilities for the handling of the coal traffic to tidewater. The traffic conditions, characteristics of the new line and construction methods were described in an illustrated article in the issue of April 14, page 847.

Long and Short Wheel Base Test Cars*

A Discussion of the Influence of the Distance Between the Wheels of Scale Testing Equipment

By C. A. Briggs

Associate Physicist, Bureau of Standards, Washington, D. C.

An accurate, thorough, and reliable test of any scale consists in establishing whether or not it will weigh correctly any load within the capacity of the scale, for all normal positions of the load on the platform. The difficulty of supplying the requisite amount of standard weights for testing scales increases rapidly with their capacity, so that scales of large capacity, such as railroad track scales, require special provisions to supply proper facilities for testing them.

The first requisite in testing railroad track scales is a large

Fig. 1—Double Truck Test Car Used by the Central of Georgia

test weight or weights, and the second is a means for applying the test weights to the scale. The test load naturally takes the form of a car of supposedly known weight, having either a long or a short wheel-base. The long wheel-base test cars are modified freight cars of some form or other. They have two 4-wheel trucks and the wheel-base is generally 19 or 20 ft. The short wheel-base test cars are designed for the sole purpose of testing scales. They generally consist of a compact car body, mounted on four wheels. In the best designs the body is practically solid, or is filled with 50-lb. weights which cannot shift about in the car. The wheel-bases of such cars vary from 5 to 9 ft.

Before proceeding with the comparison of the two types of cars it may be best to review briefly the construction of track scales: In railroad track scales the load is carried on a bridge supported at four, five, six, or more intervals known as sections. The load at each section is carried on two main levers which extend transversely to the track. The main levers are connected to a system of longitudinal extension levers which are connected to the beam by means of a transverse extension lever. The sections of the scale are adjusted by means of nose irons on the longitudinal system of extension levers.

The object of adjusting a track scale is to secure a condition such that any weight will be correctly indicated by the beam when the weight is supported by any section or sections of the scale. If the scale is properly designed and installed, the indications of a given section will not be materially affected by the loads on adjacent sections, causing deflections or distortion of the parts. The two main levers of a section cannot be tested or adjusted independently after they are installed. However, the loads imposed on track scales are symmetrically disposed with reference to the rails, and as long as the alinement of the scale parts is preserved, the two main levers of a section will carry equal portions of the load. The adjustment of the section can therefore be made in reference to the average multiplication of the two main levers.

This practically eliminates from consideration all track scales with the continuous girder construction for the scale bridge. The general use of the continuous girder in the bridges of track scales is a practice which is a serious reflection on the scale industry. There is no theory or practice of good engineering construction which can justify their use, and the results found in practice in the use of continuous girders are even more emphatic arguments against their use. As to the matter of loose main levers alone, the Bureau of Standards, in testing over 400 track scales, has found it to be the exception to find a scale with continuous girders which does not have one or more loose main levers, even when no part of the scale is loaded.

It is apparent that the errors in the individual sections are the fundamental quantities to be considered and the ideal way for imposing a test load on a scale for purposes of adjusting it would be to concentrate it on one section at a time, leaving the other sections absolutely free: Owing to practical limitations this has never yet been done.

Fig. 1 shows a long wheel-base test car used by the Central

Fig. 2—Short Wheel-Base Four-Wheel Car Used by the Pennsylvania

of Georgia. This is adapted from a freight car and in glancing at it, the fact that it is a test car is not at once apparent. Fig. 2 shows the most recent development of the short wheel-base test car type, designed and constructed by the Pennsylvania Railroad. The weight of the car is 80,000 lb. and the wheel-base is 7 ft. The entire body is made of two castings and there are practically no separate parts bolted to the car; there are, however, forty 50-lb. weights carried in a pocket in the top of the car for emergency use in testing smaller scales. A very important feature of these cars is that they have been equipped with roller bearings. Fig. 3 shows a car used by the states of Washington and Oregon. The ordinary wheel-base of this car is 19 ft. but in use the end wheels are pulled up by means of chains and the scales are tested with the car resting upon the two inside pairs of

*Abstracted from a paper prepared for the National Association of Scale Experts.

wheels. The virtual wheel-base of the car is then about 8 or 9 ft.

In all of the forms of test cars in service the wheel-base is such that when the test car is centered over any section, an appreciable portion of the test load is carried on adjacent sections and the indication of the beam is affected a corresponding amount by the errors in the adjacent section. In making adjustments, therefore, the careful scale man estimates as best he can what allowance should be made in a given section for the errors of the adjacent sections.

Long Wheel-Base Test Cars

When two-truck test cars are used the long wheel-base increases the distribution of the load among the sections and the matter of testing scales becomes complicated. The serious limitations of this form of testing equipment can be appreciated with the aid of the following figures:

Fig. 4 shows the results which can be obtained on a four-section track scale 49.5 ft. between the end sections, when tested with two-truck test-cars weighing 100,000 lb. The actual errors in the individual sections are +1,500 lb., —1,500 lb., +1,500 lb. and —1,500 lb., for sections 1, 2, 3 and 4, respectively, for a 100,000-lb. load; or a load of 50,000 lb. carried on an ordinary truck of 5.5 ft. wheel-base, would indicate an error of +500 lb., —500 lb., +500 lb. and —500 lb. when centered over the respective sections.

In this diagram and in the following ones the error indicated by the scale is plotted against the corresponding position of the center of the test car along the scale. The longer the wheel-base of the car the shorter will be the possible movement of the car on the scale before the end wheels will pass over the bridge of the scale, and the shorter will be the horizontal length of the curve. From the curves it can be seen that the results obtained depend entirely upon the wheel-base of the car. A 20-ft. wheel-base car will develop absolutely no error in any position on the scale. An 18.5-ft. wheel-base car will show errors which vary from —330 lb. to +330 lb., depending on its position along the platform; a 16.5-ft. car will show errors which vary from —500 lb. to +500 lb.; a car with a wheel-base of 26.5 ft. will show errors which vary from +420 lb. to —420 lb.; and cars with wheel-bases of 33 to 38.5 ft. will show errors which will vary from +1,000 lb. to —1,000 lb., depending upon the position of the cars along the bridge.

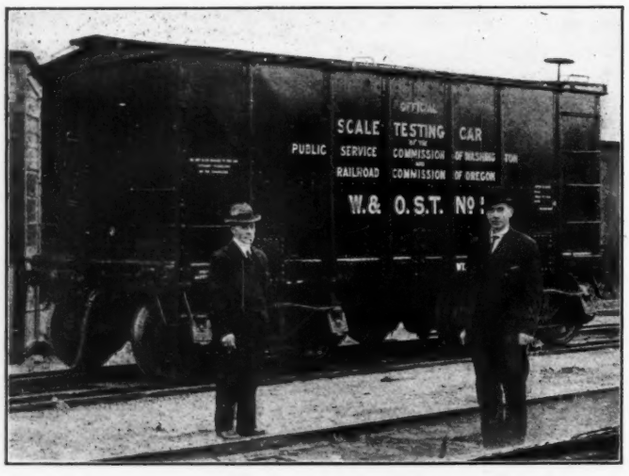


Fig. 3—Oregon and Washington State Commission Car. Eight-Wheel Car When in Transit, Four-Wheel When Used for Tests.

Cases such as this which illustrate the anomalous results which can occur when long wheel-base test cars are used can be multiplied indefinitely, but the case just considered will serve to bring out the various points. The particular errors chosen for the scales, and the wheel-bases of the cars used in the illustration were selected as a matter of convenience in drawing them in the figures. It may be observed that the 16.5-ft. wheel-base car used in the illustration is probably smaller than will be actually encountered, but this is given as it will illustrate the character of the results which will be obtained under similar conditions by longer wheel-base cars on longer scales.

In the light of the matter just considered, the absurdity of an attempt to test such scales with long wheel-base test cars is obvious. It really becomes a serious question whether or not a long wheel-base test car is worse than nothing at all. For instance, if an attempt is made to adjust a four-section track scale 50 ft. long by means of a 20-ft. wheel-base test car it will be impossible to determine the errors in individual sections, and in adjusting the scale to cause it to weigh the 20-ft. test car correctly, the adjustments are just as liable as not to be made on the wrong section; and a condition analogous to that shown in Fig. 4 will be developed. The result will be that while the scale has been adjusted to weigh the 20-ft.

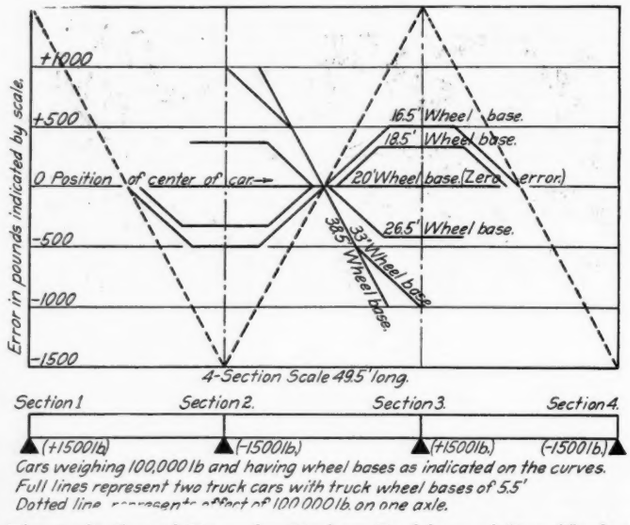


Fig. 4—Indicated Error for Various Positions of Cars Having Various Wheel Bases

wheel-base correctly, cars of different wheel-base may be weighed with greater errors than before the adjustments were made.

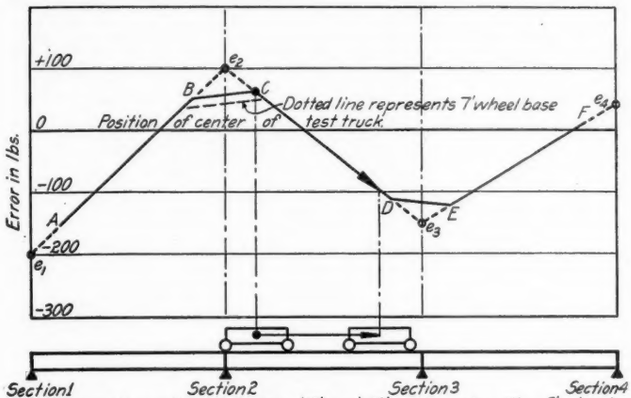
Short Wheel-Base Test Cars

Evidently recourse must be had to short wheel-base test cars if a satisfactory method of testing and adjusting scales is to be secured, and it is important to consider how these should be constructed and used. In the *Railway Age Gazette* of November 19, 1915, there appeared an article entitled "Adjusting Railroad Track Scales," which was based on a paper by H. L. Van Keuren, of the Bureau of Standards. In this paper he proposed that the test car should not be centered over the sections in making the test but that it should be used with each pair of wheels in turn centered over the sections. A trial and study of this method has been made with the result that it has now been adopted by the Bureau of Standards for its regular testing.

This new method of test is found to be particularly well adapted for graphical construction or presentation, and this avoids the necessity of making a computation in determining the errors of the sections. All that is required by the scale adjuster in the field to determine the error of the individual sections of the scale from the errors shown by the test car is a sheet of squared paper, a pencil and a rule.

This can be understood with the aid of Fig. 5. In this

figure is shown the error indicated by a scale traversed by a 50,000-lb. test car on a 5-ft. wheel-base, plotted against the position of the center of the test car on the scale. The errors are —200 lb., +100 lb., —150 lb., +40 lb., for sections 1, 2, 3 and 4, respectively, corresponding to a 50,000-lb. test load. It will be observed that this curve of error is made up of straight line elements. The portions of the curve AB, CD, EF, give the error when the test car is confined to but one span at a time; and the portions of the curve BC and DE give the error for positions of the car where two of the wheels are on one span, and the other pair of wheels are on an adjacent span, thus involving three sections. It can be seen



Test of a 4 section articulated girder (16' span) 48' track scale with a 5' wheel base 50,000 lb. test load. The errors of the individual sections, e_1, e_2, e_3 and e_4 are respectfully -200 lb., +100 lb., -150 lb., and 40 lb. as indicated

Fig. 5—Graphical Method for Determining the Actual Errors of Individual Sections

that if the lines AB, CD and EF are extended they will intersect the vertical lines, which represent the positions of the nearest sections of the scale, at points which correspond to the errors of the sections of the scale.

It should be noted that for the inside sections there are two lines which can be used to establish the errors of the scale. For instance, in section 2 the error C_2 can be established by either line AB or CD. This gives a check in the actual tests on the condition of the scale, for if the two lines do not intersect at a common point to within the constancy of the scale, it indicates that conditions are not right with the scale. This may be the result of loose main levers, loose knife-edges, knife-edges which are not parallel, imperfect bearings and alinement of the parts, binding, etc. If observations are made for intermediate positions of the test car an additional check is had in the fact that the errors so indicated should lie on a straight line between the points established on either side by the regular test positions.

This graphical presentation makes clear another fact, not previously mentioned,—that the maximum errors indicated by the test car are not shown when the test car is centered over the sections but when it is in the off-set positions; and the same is true in reference to the trucks of freight cars being weighed on the scale.

The Maximum Length of the Wheel-Base for Test Cars

It has just been shown how the determination of the errors of the sections corresponds to extending straight lines which are fixed by two points corresponding to observed errors. These observed errors are the subject of variations on account of small shifts of balance and changes which occur in scales. It is apparent that if a straight line is established by points which are subject to error, the points should be as far apart as possible. It is therefore best to use as short a wheel-base as possible so that the points in the present case will be widely separated.

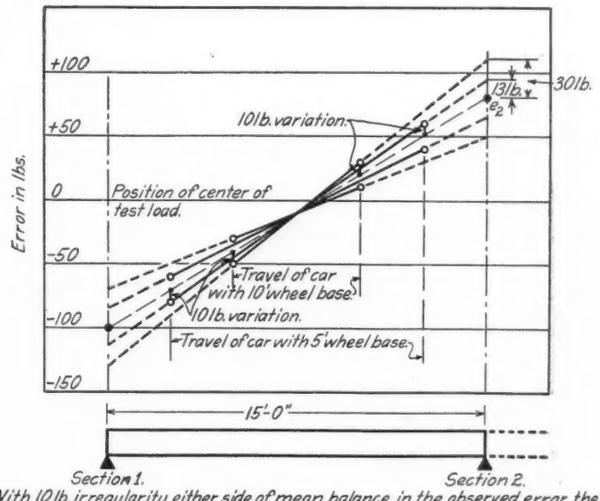
This can be made clear with the aid of Fig. 6. This shows the uncertainty in establishing the error of the sections which may result from an uncertainty or variation of balance of 10 lb. from the mean indication of the scale,—for 5-ft. and 10-ft. wheel-base test cars, on a 15-ft. span.

The largest discrepancy in establishing the error of a section will occur when the error in balance is in one direction for one position of the test car, and in the other direction for the other position of the test car. This is indicated in the figure.

With an irregularity of the indication of the scale either side of the mean indication, as given by the line e_1 e_2, the corresponding uncertainty in establishing the actual errors in the sections is 13 lb. for a 5-ft. wheel-base car, and 30 lb. for a 10-ft. wheel-base test car. This uncertainty in establishing the errors of the sections does not depend upon the actual errors, e_1 and e_2, in the sections, for, if there are given any other values under the conditions of variation just outlined, the same variation in the errors of the sections will be obtained as before.

The uncertainty in establishing the errors of the sections increases at an increasing rate as the wheel-base of the test car increases, and it becomes important to consider the limits in the wheel-bases which should be used for test cars. After considering the various kinds of scales in use, the length of their sections, the character of their errors and variations, etc., it appears that the wheel-base of test cars should not exceed 7 ft., and that a 5-ft. or 5½-ft. wheel-base should be used if possible.

The matter of the number and weight of test cars which



With 10 lb. irregularity either side of mean balance, in the observed error, the corresponding uncertainty in establishing the actual errors in the sections is 13 lb. for a 5' wheel base test car, and 30 lb. for a 10' wheel base test car.

Fig. 6—Diagrams Showing How the Inaccuracies in Testing Track Scales Increase as the Wheel-Base of the Test Truck Increases

should be used in testing scales, the tolerances and allowable variations in the action of scales, and various other subjects intimately connected with the proper test of scales, cannot be discussed here.

The following summary gives the general deductions made in the present paper:

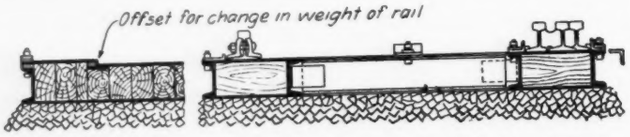
1. Long wheel-base test cars are inadequate for properly testing scales and should not be used.

2. Short wheel-base test cars should be used, the wheel-base should not be greater than 7 ft., and preferably should be 5 or 5½ ft.

3. The most advantageous way of using the short wheel-base test car is not to center the car over the sections but to place each pair of wheels in turn over the sections.

AN IMPROVED CROSSING FOUNDATION DESIGN

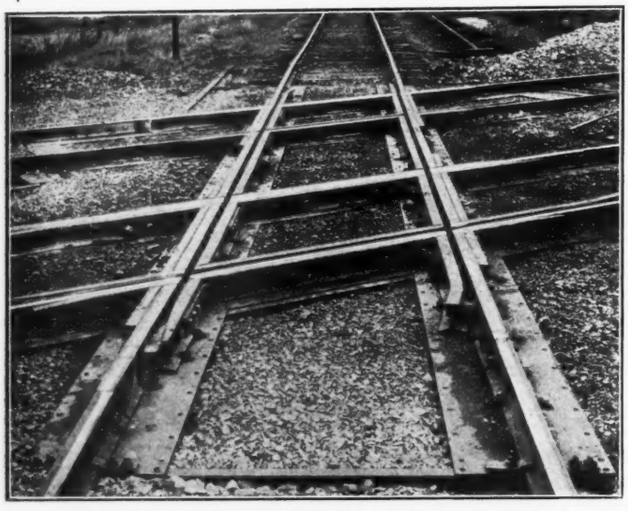
The International Steel Tie Company, Cleveland, Ohio, has recently made a material change in the design of the steel substructures for railway crossings which that company has been building for a number of years. This crossing foundation consists of a system of shallow box girders, one supporting each rail and joined at the intersections to form a rigid unit. There are 86 of these crossings now in use, most of which are at intersections of electric lines with steam railroads or street railway crossings. They have also been



Longitudinal and Cross-Sections of the Timber Filled Crossing Foundation

used recently at a number of intersections of steam railroads, among these may be mentioned a crossing of the Big Four and the Wheeling and Lake Erie at Wellington, Ohio, and a crossing of the Queen & Crescent and the Louisville & Nashville at Junction City, Ky.

The behavior of these crossings under service is indicated by the experience with the substructure for a crossing of the Big Four at Washington street, in Springfield, Ohio, with a street car line. This substructure was installed in May, 1914, and is one of four in use on that railroad. The crossing has been surfaced once since it was put in place, namely, in October, 1915. Very little surfacing was necessary but as no drainage had been provided when the crossing was put in,



Crossing of the Baltimore & Ohio and the New York Central at Parma, Ohio

an entire change of ballast was made at that time. The substructure was found to be standing up very well under a traffic consisting of an average of 600 loaded cars per day. The cost of this crossing foundation was $795 for the substructure, and $300.85 for the installation, giving a total of $1,195.85. This is of course greater than the cost of a crossing installed on ties, but before the steel substructure for the crossing was put into place, it has been necessary to surface it at least once each month, necessitating the removal and replacing of the crossing planks each time. In view of the decrease in the cost of maintenance since the new installation has been made, it is believed that the greater cost of installation will be easily justified. The saving in maintenance cost is estimated at 75 per cent. in cases where paving or planking must be removed in order to get at the ballast.

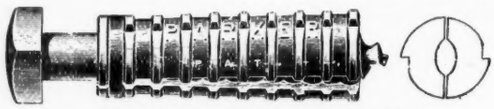
It has been the practice, in the crossings built up to the present time, to fill the box girders with concrete. This is being replaced with creosoted timber in a new design, as shown in the accompanying drawing. The girder consists of two channels with top and bottom cover plates forming a box which is filled solid with creosoted blocks laid with the grain transverse, all small crevices being filled with hot pitch. The bottom cover plate is not riveted into place until the blocks have been set. The rails are secured to the girders by clip washers through the outstanding flanges along each side of the girders and at the ends, where channels are used as ties. The drawing also shows how the compromise is made when the crossing involves two heights of rail by placing a filler of the correct thickness between the top cover plate and the channel.

Several advantages are claimed for this change in design, of which one of the most important results from the fact that the crossing foundation can be completed entire before leaving the shop. According to the old scheme the concrete had to be filled into the box girders at the site of the crossing, because the weight of the concrete made it impractical to ship the sections with the concrete in place. Although these crossing substructures have been successful with the use of concrete, there have been instances where, because of freezing, poor material or insufficient time for setting or curing the concrete filling disintegrated in service. The use of the timber-filled structure eliminates all possibility of any failure from improper workmanship in the field, which is not under the control of the manufacturer.

AN IMPROVED EXPANSION SHIELD

The Parker Supply Company, New York, has put on the market an improved lag screw type expansion shield, which embodies two features; a resistance to a turning tendency on the part of the shield when the lag screw is being turned up and a convenient method for holding the two halves of the shield together while it is being applied.

These shields consist of two hollow semi-cylindrical castings made in pairs, having screw threads on the interior surface and circumferential ribs on the outside which are characteristic of the various types of Parker expansion shields. On the new type the ribs are not continuous, but are cut off



Lag Screw Expansion Shield

at diametrically opposite points, thus forming lugs or stirrups which resist rotation in a clock-wise direction as the lag screw is being turned into the shield; that is, the ends of the ribs cut into the surface of the hole into which the lag screw has been inserted.

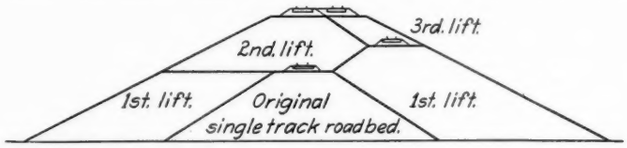
The other improvement consists of a steel spring band which fits into the groove between the two ribs nearest the outer end of the shield. As this band is not a complete ring, but a curved piece of flat steel which is sprung onto the shield, it holds the halves securely together, but permits the expansion which accompanies the insertion of the lag screw.

These lag screw shields are made for ten different sizes of bolts varying from ¼ in. to 1 in., inclusive, in diameter, and with three different lengths of shields for each size of bolt except the three largest. Special lag screws are not required; the shields will fit those furnished by any leading manufacturer. They are suitable for use in concrete, stone or brick work in buildings, bridges and other structures and have been used in railroad structures on the Baltimore & Ohio, the Pennsylvania Railroad and the Erie.

Raising the Grade on a High Embankment

Methods of Handling Traffic and Overcoming Slides in Enlarging the Approach Fill for the Bridge at Sibley, Mo.

The east approach to the Missouri river bridge of the Atchison, Topeka & Santa Fe at Sibley, Mo., consists of an embankment 2½ miles long. When the bridge was re built during 1911 to 1914, inclusive, as described in the *Railway Age Gazette* of July 2, 1915, the embankment was widened to provide for double track and raised a maximum of 22 ft. to reduce an 0.8 per cent approach grade to 0.5 per cent. The maximum height of the new embankment is 56 ft., and the change involved 1,750,000 cu. yd. of fill, which was taken from a steam shovel cut three miles west



Various Steps in the Construction of the Embankment

of the embankment and across the bridge. The embankment is separated from the bridge proper by a viaduct 2,000 ft. long, the east end of which also had to be raised 6.9 ft. to accommodate the change in grade line.

This work formed a part of a project for the completion of double track on the Missouri division. Previous to starting this work there was single track for eight miles between Camden Junction and Sibley, located east and west of the bridge respectively. The work as now completed provides double tracks 14 ft. center to center except across the bridge where gauntlet tracks are used with number 20 frogs at each end.

The larger part of the original embankment was obtained from borrow pits on either side of the line, which contained standing water in wet weather and had caused slides and settlement of the roadbed and tracks from time to time. The purchase of sufficient right of way to eliminate this difficulty was included in the estimate for the change in grade, and the preliminary work was therefore directed to the rectifying of these difficulties. The old borrow pits were filled with teams by contract, borrowing material from the further side of the new right of way and making surface ditches parallel with the tracks near the property lines with as much fall as possible from the roadbed to carry surface water to this ditch. While the filling of the borrow pit was in progress trenches were cut through the original embankment and filled with rip rap and crushed rock to drain water from pockets under the tracks. At the same time as much as possible of the cinders and ballast which had become depressed into the roadbed in consequence of previous soft conditions was removed, and the embankment was restored with more impervious material.

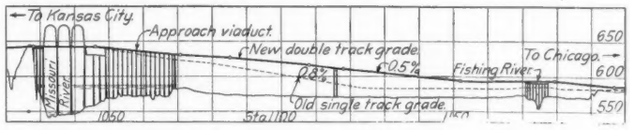
After this preliminary work had been completed two 90-ton-Bucyrus steam shovels with 5-cu. yd. dippers were installed in a pit three miles to the west, and work train service was employed with 20-yd. Western dump cars to haul the material. From 2 to 6 trains were used with 20 cars per train. Owing to the fact that the line was single track, and that construction work was in progress on the bridge throughout almost the entire time, very careful operating arrangements were necessary to avoid undue delays of either the revenue traffic or the movement of the work trains.

The embankment was enlarged according to the program shown on the accompanying diagram. Work was started by putting in the bases of the enlarged embankment on both sides of and up to a level of the original embankment. This was completed by June, 1913. The grade line of this lift was then raised on the south side to make approximately one-half the raise required, or about 11 ft. The top of this lift was put in on a grade line of 0.64 per cent, except for a run-off at the east end of the bridge to take care of the raise of approximately 7 ft. required at the end of the viaduct. The dry weather permitted this work to be done with small risk of interference with traffic on the original line from the adjacent slope of the new work. Traffic was transferred to a track on top of this first lift in September, 1913. The original track was then removed and work was started on the formation of the complete embankment for the westbound track.

Difficulty With Slides

Satisfactory progress was made on this portion of the work until May, 1914, when the great weight of this embankment caused a settlement of the natural ground surface on which it rested, with corresponding upheavals beyond the toe of the slope, and slides of large proportions. This situation interfered to such an extent with the movement of the dirt trains that it became necessary to discontinue nearly all of the hauling and devote most of the attention to the repair of these slides. During this period the raise of grade was made in the east approach of the viaduct and the temporary run-off at this point was taken out.

It was concluded that to stop the slides it would be necessary to excavate a trench through the soft material on which the embankment rested at the toe of the slope, backfill it with clay and then build a berm over it to one-third the height of the embankment to serve as a counter-balance for the weight or thrust of the sliding material. In addition, 11 rock drains were built through the slides from the bottom of the ballast under the original main track to a sump



Profile of the East Approach to the Sibley Bridge

in the foundation trench sunk in quicksand and filled with rip rap to provide an outlet for the drains. These drains were 4 ft. wide and were filled for 6 ft. with rip rap and crushed rock, 2 ft. of the latter being placed on the top and sides to act as a filter.

Other slides, from 300 to 1,500 ft. in length, developed during the summer, and in July it was arranged to have from 60 to 80 teams handle the repair of these slides. An unloading track was also laid along the north side of the embankment at about one-third of its height for the purpose of building a continous berm with material from the steam shovels. After all these measures had been completed work was resumed on the enlarging of the embankment.

The embankment for the west bound track was completed in November, 1914, and the track was soon ballasted and placed in service. The temporary traffic track on the south side was then taken up and the filling of the east bound main was resumed until slides and settlements started on that side. It was, therefore, necessary to discontinue the filling until the same measures for drainage and counterbalancing were taken as had been found necessary on the

north side. The embankment for the east bound track was completed, the track was put in place and double track was placed in service in May, 1915.

Wet weather interfered with the work to a considerable extent and developed slides and a heavy washing and sloughing of the material on the shoulders of the berms, but after these were completed there was no more trouble with this embankment than would be expected with any new earth embankment of an equal height.

Handling the Work Trains

Three salient factors presented themselves in the preparation of plans for the handling of the construction trains between the shovel cut and the embankment, in addition to the regular revenue traffic. These factors were, first, the necessity for keeping the revenue traffic moving without delay, second, that of avoiding serious interference with the construction work and third, the fulfillment of these conditions without the sacrifice of safety or undue expense.

It was absolutely necessary that the passenger and fast freight trains be handled on the normal schedule in order to retain the business. Some modification was permissible in the schedule for the slow freight movement. The working hours for the construction work were from 7 a. m. to 6 p. m. A check of the traffic through the affected zone during that period showed a total of seven passenger trains, seven fast freight or fruit trains, and four slow freights. It was decided that the four slow freight trains or approximately 22 per cent of the traffic could be diverted to other hours of the day.

This did not prove as difficult as might appear, particularly for the east bound trains. Under normal conditions the most desirable period for starting these trains out of Kansas City is from 9 p. m. to 5 a. m. and from noon to 3 p. m., as trains starting at other times during the day usually become entangled in the heavy passenger movement. It was possible, therefore, to start the evening east bound slow freight trains on the normal schedule and check the day movements not to exceed three or four hours to avoid having the trains arrive at the bridge site between 7 a. m. and 6 p. m.

On the west bound slow freight movement the situation was more difficult as it was necessary to check the movement as far east as Chicago. What little slow freight did accumulate was disposed of each Sunday with fair regularity.

No reasonable expense was evaded in making arrangements to handle the situation. The despatcher handling the district in which bridge zone was located, was relieved of an important branch line so that he could devote his entire time to the main line movement. Before construction work was started, the two block offices contiguous to the bridge were at Sibley and at Floyd, a station four and one half miles east of the bridge. Additional offices were immediately located at each end of the bridge and at the shovel pit, making a total of five in the seven miles between Floyd and the pit. Two of these were open for 24-hour periods, two for 12-hour periods and the one at the east end of the bridge for 18 hours. The latter office was kept open during the evening to assist in the movement of the west bound slow freight trains which began to arrive at this point soon after six o'clock. The establishment of adequate telephone service permitted the despatcher to keep in constant contact with every development, no matter where it occurred.

The work trains averaged 10 round trips per day through the zone, in addition to which there were approximately 7 passenger trains, 8 freight trains, and a bridge construction train. On some days, however, it was necessary to dispose of 10 passenger trains and as many freights and at some times the work train round trips averaged as high as 16. In addition to the measures mentioned above an effort was made to have either the superintendent, train master or road-master on the ground continually, to be ready for any emergency that might arise.

Sufficient track facilities were provided at the stations on either side of the bridge to provide for the work equipment. An improvised cinder pit at Sibley took care of an average of four work train engines each night. An experienced roundhouse man was placed in charge and was provided with sufficient help to insure good service. As a result, little or no difficulty was experienced through power failures during the progress of the work.

While all concerned understood that the work was to be pushed with all facility contingent with safety, it was definitely understood that nothing of a hazardous nature was to be undertaken to facilitate the movement of traffic or the progress of the work. Thanks to this precaution, the whole period embracing over two years was not marred by an accident of any magnitude. On the other hand the construction work was not hindered to any appreciable degree, while the check on the traffic was negligible. The total delay to all trains passing through the bridge zone in the two years of construction aggregated 188 hours of which 18 hours, or nearly 10 per cent, was the direct result of the destruction of false work by an ice jam. Although this did not injure the bridge it occurred during the night and all traffic was suspended until a thorough examination could be made. During the entire construction period of 24 months, it was necessary to detour only 65 trains although the division took all the business that was offered.

The handling of the construction work on the embankment as well as that on the bridge was under the direction of G. J. Bell, at that time division engineer, and F. H. Frailey, assistant engineer. The handling of the traffic and construction trains was under the direction of R. H. Allison, division superintendent, and under the supervision of R. J. Parker, general superintendent.

TEST OF DOUGLAS FIR BRIDGE STRINGERS*

By H. B. MacFarland

Engineer of Tests, Atchison, Topeka & Santa Fe

The object of this test was to determine whether the moisture could be properly removed from Douglas fir stringers by a process of creosoting involving boiling under vacuum, and to determine whether this method of treatment had a detrimental effect on the physical properties of the material. Former tests have demonstrated that the strength of Douglas fir is decreased approximately one-third when the material is subjected to any process of creosoting involving high temperatures during treatment.

The St. Helens Creosoting Company, St. Helens, Ore., submitted some experimental data on small specimens showing that the strength of Douglas fir is not appreciably affected when the moisture is removed by boiling under vacuum, preliminary to creosoting. Arrangements were made with this company to treat a test lot of 100,000 ft. of 7-in. by 16-in. by 30-ft. commercial bridge stringers by the process of removing the moisture by boiling under vacuum, at a temperature of from 180 to 190 deg.

The work at the treating plant was conducted from November 1 to 10, 1915, actual treating taking place from November 4 to 8, 1915. The regular plant equipment was used, care being exercised to check all gages and thermometers by calibrated instruments taken from the Topeka laboratory.

From the lot of 356 stringers in this order, 61 were selected for test purposes. Fifty-two of these stringers were cut in two, the two halves given corresponding test numbers, one-half being treated and the other half held as a control, to

*Abstracted from Bulletin 184 of the American Railway Engineering Association.

determine the effect of the treatment on the wood. Nine stringers were selected after treatment for special tests. All specimens selected for tests were representative of the entire lot, as to physical structure and prevailing defects.

In the boiling under vacuum process of creosoting as practiced by the St. Helens Creosoting Company, the charge of green or water-soaked timber is placed in the retort, which is then filled with creosote oil at a temperature of from 150 to 180 deg. F. The temperature of the oil is gradually increased to 190 deg. F., and then held at that temperature, under atmospheric pressure, until the timber is uniformly heated. A vacuum is then drawn and the temperature maintained at 190 deg. F. to remove moisture. In treating this material the preliminary heating period was 5 hr. after the charge had attained the desired temperature. The boiling under vacuum was continued until the average condensation for two consecutive hours was less than 0.1 lb. of water per cu. ft. of timber per hour; this required from 14 to 15½ hr., at the end of which period additional oil was added and 5 to 10 lb. pressure applied to insure the retort being full of oil before the pressure pumps were started.

The steam in the heating coils was then turned off and oil pumped from the measuring tanks into the retort. The pumping was continued and the pressure in the retort was increased until the desired treatment of twelve pounds per cubic foot was forced into the timber. This operation required from four and one-half to six hours and the pressure reached a maximum of 132 lb. per sq. in. The oil was then forced back into the high tank with air pressure, and a vacuum drawn on the retort for 30 minutes to surface dry the charge.

The condition of the timber as to moisture and creosote before and after treatment in pounds per cubic foot is shown by the following table:

Charge No.	Plant No.	Retort	Moisture: Before treatment	Moisture: After treatment	Moisture removed	Moisture and creosote	Creosote
1	172	E	10.3	6.6	3.7	19.9	13.3
2	173	F	10.7	7.0	3.7	18.2	11.2
3	174	F	10.3	7.4	2.9	18.1	10.7
4	175	E	10.8	7.0	3.8	17.3	10.3

The moisture content in the treated specimens was slightly greater at the time of test than just after treatment, as shown by difference in weights at St. Helens and at Topeka.

The removal of moisture, either by air drying or by artificial drying, constitutes the seasoning of timber. Former laboratory tests have shown a slight increase in the physical strength of treated Douglas fir, due to seasoning.

The transverse tests show that the effect of treatment on the strength of Douglas fir stringers is as follows:

	Pounds per square inch: Maximum	Minimum	General average	Per cent
Elastic limit:				
Treated	5,280	1,436	3,481	82
Untreated	5,610	3,140	3,269	100
Modulus of rupture:				
Treated	6,690	3,020	4,680	82
Untreated	7,990	4,105	5,691	100
Modulus of elasticity:				
Treated	2,136,400	1,276,700	1,666,200	98
Untreated	2,153,800	1,204,400	1,701,900	100
Longitudinal shear:				
Treated	475	216	333	81
Untreated	565	299	411	100

These data show in the transverse tests that the elastic limit and modulus of rupture are decreased 18 per cent due to this treatment; the modulus of elasticity is decreased only 2 per cent and the shearing strength is decreased 19 per cent.

A general classification of a number of failures in transverse tests for treated and untreated specimens follows:

	Longitudinal shear: No. of failures	Per cent of total	Tension: No. of failures	Per cent of total	Miscellaneous: No. of failures	Per cent of total
Treated	32	62	14	27	6	11
Untreated	16	31	29	56	7	13

From this table it is seen that for the treated specimens a majority failed by longitudinal shear, while of the untreated specimens, the majority failed by tension.

The compression tests parallel to the grain show that the effect of treatment on the strength of Douglas fir is as follows:

	Pounds per square inch: Maximum	Minimum	General average	Per cent
Elastic limit:				
Treated	5,080	2,358	3,629	94
Untreated	5,173	2,611	3,873	100
Maximum load:				
Treated	5,235	2,590	3,869	94
Untreated	5,536	2,750	4,114	100
Modulus of elasticity:				
Treated	814,500	409,500	607,110	101
Untreated	811,000	413,000	601,020	100

This table shows that in compression the strength of this material is decreased 6 per cent at the elastic limit and 6 per cent at the maximum load, due to treatment. The modulus of elasticity shows the treated material 1 per cent stiffer than the untreated material. The specimens for this test were sawed from the material after transverse test, and had a part of the area of the treated specimens penetrated by creosote.

The compression tests perpendicular to the grain show that the effect of treatment on the strength of Douglas fir is as follows:

	Pounds per square inch: Maximum	Minimum	General average	Per cent
Elastic limit:				
Treated	615	206	322	74
Untreated	627	346	438	100
Load for deflection of ⅜-in.:				
Treated	900	450	640	82
Untreated	1,100	590	780	100

This table shows that the strength of this material in compression was decreased, due to treatment, by 26 per cent at the elastic limit and by 18 per cent at a load which caused ⅜-in. deflection.

Conclusions

The results of these tests indicate the following conclusions relative to the boiling under vacuum process of creosoting Douglas fir bridge stringers:

1. The moisture may be successfully removed by boiling under vacuum for the proper treatment of the material. Moisture determinations show that on an average 35 per cent of the total moisture was removed by this process.

2. The removal of moisture by the boiling under vacuum process, preliminary to creosoting, decreases the physical strength of the material.

3. The weight of creosote per unit of volume for treated material is dependent on the structure of the specimen. The spring wood offers greater resistance to treatment than the summer wood.

4. A special test of treated stringers 53 and 55 indicates that the decrease in physical strength due to treatment is not confined to the area penetrated by creosote, but that the entire structure is affected.

6. The compressive strength parallel to the grain was decreased 6 per cent, due to the boiling under vacuum process.

7. The compressive strength perpendicular to the grain was decreased 26 per cent, due to the boiling under vacuum process.

8. Although the average strength of the treated material is appreciably decreased, its stiffness, as measured by the modulus of elasticity, is not affected.

9. In general, the average strength of Douglas fir bridge stringers, subjected to the boiling under vacuum process of creosoting, was five-sixths of its original strength.

English Tax on Railway Tickets Withdrawn.—Edwin S. Montagu, financial secretary to the treasury, announced in the House of Commons April 12 that the government had decided to withdraw the tax on railway tickets.

PRODUCTION OF RAILS IN THE UNITED STATES IN 1915

The American Iron and Steel Institute, New York, has issued a bulletin giving the production of rails last year based on statistics furnished by the various manufacturers. The total output for the year was 2,204,203 tons, or 259,000 tons more than the very low production of 1914, but still 1,299,000 tons less than the output in 1913. The material improvement in business conditions during the last months of 1915 came too late to have any influence on the rail production for that year.

PRODUCTION OF RAILS BY PROCESSES, IN GROSS TONS

Years	Open-hearth	Bessemer	Rerolled	Electric	Iron	Total
1897.....	500	1,644,520	.....*	.....	2,872	1,647,892
1898.....	1,220	1,976,702	.....*	.....	3,319	1,981,241
1899.....	523	2,270,585	.....*	.....	1,592	2,272,700
1900.....	1,333	2,383,654	.....*	.....	695	2,385,682
1901.....	2,093	2,870,816	.....*	.....	1,730	2,874,639
1902.....	6,029	2,935,392	.....*	.....	6,512	2,947,933
1903.....	45,054	2,946,756	.....*	.....	667	2,992,477
1904.....	145,883	2,137,957	.....*	.....	871	2,284,711
1905.....	183,264	3,192,347	.....*	.....	318	3,375,929
1906.....	186,413	3,791,459	.....*	.....	15	3,977,887
1907.....	252,704	3,380,025	.....*	.....	925	3,633,654
1908.....	571,791	1,349,153	.....*	.....	71	1,921,015
1909.....	1,256,674	1,767,171	.....*	.....†	.....	3,023,845
1910.....	1,751,359	1,884,442	.....*	.....†	230	3,636,031
1911.....	1,676,923	1,053,420	91,751	462	234	2,822,790
1912.....	2,105,144	1,099,926	119,390	3,455	.....	3,327,915
1913.....	2,527,710	817,591	155,043	2,436	.....	3,502,780
1914.....	1,525,851	323,897	95,169	178	.....	1,945,095
1915.....	1,775,168	326,952	192,083	.....	.....	2,204,203

*Included with Bessemer and open-hearth steel rails from 1897 to 1910, inclusive.

†Small tonnages rolled in 1909 and 1910, but included with Bessemer and open-hearth rails for these years.

PRODUCTION OF RAILS, BY PROCESSES.

Kinds.	1915	Per cent	1914	Per cent	Increase	Per cent
Open-hearth	1,775,168	80.54	1,525,851	78.45	249,317	16.34
Bessemer	326,952	14.83	323,897	16.65	3,055	.94
All other	102,083	4.63	95,347	4.90	6,736	7.06
Total	2,204,203	100.00	1,945.095	100.00	259,108	13.32

The relative proportion of open hearth rails continued to increase, representing 80.54 per cent of the total as against 78.45 per cent in 1914 and 72.16 per cent in 1913. An interesting detail is noted in an increase of over 160,000 tons in the production of rails weighing 100 lb. per yd. or more, in contrast with a decrease of 125,000 tons in rails weighing 85 lb. and less than 100 lb.

PRODUCTION OF RAILS BY WEIGHT PER YARD, 1897-1915.

Years.	Under 45 pounds	45 and less than 85	85 and less than 100	100 pounds and over	Total, Gross tons
1897.....	88,896	1,223,435	335,561		1,647,892
1898.....	123,881	1,404,150	453,210		1,981,241
1899.....	133,836	1,559,340	579,524		2,272,700
1900.....	157,531	1,626,093	602,058		2,385,682
1901.....	155,406	2,225,411	493,822		2,874,639
1902.....	261,887	2,040,884	645,162		2,947,933
1903.....	221,262	1,603,088	1,168,127		2,992,477
1904.....	291,883	1,320,677	672,151		2,284,711
1905.....	228,252	1,601,624	1,546,053		3,375,929
1906.....	284,612	1,749,650	1,943,625		3,977,887
1907.....	295,838	1,569,985	1,767,831		3,633,654
1908.....	183,869	687,632	1,049,514		1,921,015
1909.....	255,726	1,024,856	1,743,263		3,023,845
1910.....	260,709	1,275,339	2,099,983		3,636,031
1911.....	218,758	1,067,696	1,536,336		2,822,790
1912.....	248,672	1,118,592	1,960,651		3,327,915
1913.....	*270,405	†967,313	2,265,062		3,502,780
1914.....	*238,423	†309,865	868,104	528,703	1,945,095
1915.....	*254.101	†518.291	742,816	688,995	2,204,203

*Includes rails under 50 pounds.
†Includes 50 pounds and less than 85 pounds.

PRODUCTION OF ALLOY-TREATED STEEL RAILS, 1909-1915.

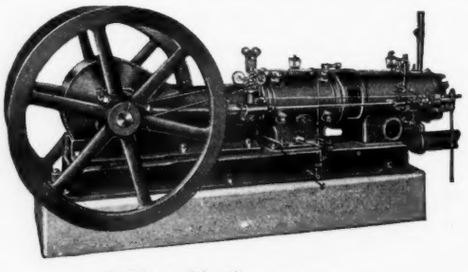
Years	Total production, Gross tons	Production by alloys: Titanium	Production by alloys: Other alloys	Production by processes: Open-hearth and elect.	Production by processes: Bessemer	Production by weight per yard: Under 45 lbs.	Production by weight per yard: 45 and under 85 lbs.	Production by weight per yard: 85 and 100 lbs and under 100 lbs.	Production by weight per yard: 100 lbs. and over
1909.	49,395	35,945	13,450	13,696	35,699	..	9,132		40,263
1910.	257,324	256,759	565	27,389	229,935	..	70,170		187,154
1911.	153,989	152,990	999	38,539	115,450	..	27,097		126,892
1912.	149,267	141,773	7,494	40,393	108,874	21	5,426		143,820
1913.	59,519	47,655	11,864	33,567	25,952	*91	†9,414		50,014
1914.	27,937	23,321	4,616	27,447	490	*14	†1,168	8,301	18,454
1915.	24,970	21,191	3,779	24,367	603	*6	†1,977	6,555	16,432

*Includes rails under 50 pounds.
†Includes 50 pounds and less than 85 pounds.

A NEW FUEL OIL DRIVEN AIR COMPRESSOR

Commendable economies in operation are reported for a fuel oil driven air compressor recently put on the market. As shown by the illustration, this compressor is of the horizontal, straight line, single-stage type, with the compressing cylinder bolted to the main frame and closely connected in tandem to the power end. The propulsive cylinders are of the valveless, two-cycle, low compression design. Ignition is produced by a positive acting, hot-plate system that eliminates all electric apparatus, such as magnetos, timers, mixers and spark plugs. As in the Diesel engine, combustion takes place at the end of the compression stroke. Air only is compressed in the cylinder, and combustion is so complete by the time the exhaust port is opened that the fuel loss is said to be negligible. The result is attained through the medium of a small oil pump which injects the fuel against the hot plate on the piston as it approaches the end of the compression stroke. Increased economy is obtained by the use of water with the fuel oil. The quality of both oil and water admitted to the combustion chamber is controlled by a fly-ball governor.

Compressors of the type illustrated are guaranteed to run on any mineral oil of 28 deg. Beaume scale or lighter, containing not over 1 per cent sulphur. There are a number of oils well below 28 deg. Beaume scale on which they will operate satisfactorily, but this depends upon the characteristics of the particular oil, such as its asphaltum content, free-



A New Air Compressor

dom from sand, etc., so that a general guarantee cannot be given, though recommendations for heavy oils can and will be made. Most of the common crude oils, fuel oils and residuums are naturally included in the above guarantee. A few of the well-known oils which may be used for the operation of the compressors are star oil, diesol, calol, stove oil, solar oil, gas oil, kerosene, and all of the distillates between kerosene and lubricating oil.

A number of the above fuels are obtainable for 3 cents per gal., so that the compressors are warranted to compress air to 100 lb. pressure at a cost not exceeding $0.56 per day of nine hours for 100 cu. ft. of free air per min. delivered to the receiver. There are many of these machines in service with daily records of fuel consumption which are said to bring their costs of operation well under the amount stated.

The new compressors are made in both single and duplex machines. Single compressors come in six standard strokes 8, 10, 12, 14, 18 and 21 in. The smaller sizes may be tank-mounted and the larger types set on skids, so that their use is not confined to stationary requirements. The manufacturer is the Chicago Pneumatic Tool Co., Chicago, Ill.

FRENCH CANAL RATES IN WAR TIME.—The war has exercised one peculiar influence on transport conditions in France, and that is a notable increase in the price of carriage by inland waterways. Since the beginning of the war this increase has, in fact, been such that on certain routes such as that between Rouen and Nancy, the cost of transport by water is greater than that of carriage by railway.

Recent Developments in Roadbed Drainage

A Description of the Methods Used on a Busy Main Line Division of the Pennsylvania and the Economies Effected

By W. F. Rench
Supervisor, Pennsylvania Railroad, Perryville, Md.

The Philadelphia and Washington line of the Pennsylvania Railroad has been confronted for a long period with the problem of providing effectual longitudinal drainage for a number of wet cuts. It is believed that the problem has finally been solved by the use of 12-in. glazed terra cotta pipe laid beneath the two side ditches. Although the method is employed at many other points, it probably is nowhere as extensively used. There is now in place on that division a

Checking the Grade of the Ditch Against the Track Grade with a Hand Level

total of 67,000 lineal ft. of such pipe, occurring at 42 different locations distributed uniformly over the line.

The Maryland division in a general way follows the "fall-line," or inner boundary of the coastal plain. The road intersects many water courses tributary to the Delaware river and to Chesapeake bay, and in crossing the several water sheds is frequently located in cuts. Many of these cuts contain springs which find their outlets in the surface ditches, not only interfering with the prompt discharge of the storm drainage, but also rendering the roadbed soft. The passenger service is frequent and a high rate of speed is maintained. There is also a considerable freight traffic, consisting largely of perishable foodstuffs from the south for metropolitan markets, which are likewise moved on a fast schedule.

To meet the requirements of this exacting service many schemes for draining these wet cuts had been tried, each furnishing temporary relief, but eventually ending in failure. The most promising of these was a longitudinal terra cotta drain laid with open joints; but the pipe was only 6 in. in diameter and soon clogged up with dirt. When the water no longer had an outlet, the unequal pressures in the soil caused the drain to buckle and eventually to become entirely disrupted. It was not unusual to find the pipes protruding vertically above the ditch. The present development of the method has been tested at certain points for four years, and there seems to be no doubt that the benefits are permanent.

A typical example is a cut 1,600 ft. long with the grade of the road descending from the middle in both directions at a rate of 0.4 per cent. The grade of the drain was, therefore, established parallel with that of the track. The draining of the cut was necessary to avoid excessive maintenance costs in lining and surfacing and to afford as smoothly riding track at all times as is obtained at other points. It was the rule for the track force to spend one day each week in this cut, the extent of which was 1/10 that of the entire section. Thus there was an excessive cost of maintenance and the appearance of the road was also unfavorable.

The preliminary stage in the treatment of the case included the sloping of the wet bank and the developing of a growth of vegetation. This was accomplished in the short period of six months by the use of street dirt spread 2½ in. thick and sown with a mixture of grass seed especially adapted to wet soils. These provisions were necessary because of the extreme wetness of the bank, which rendered the digging of a ditch 4 ft. deep almost impracticable without this advantage. Two photographs show the work of installing the drains in progress. The maintenance features of this piece of road are now on a par with those where no drainage deficiency has ever existed. The cost of lining and surfacing this stretch of road was formerly $440 per year and it has been reduced one-half. The labor cost of placing the drain was $260. The

The Pipes Are Packed in Straw to Keep Dirt Out of the Joints

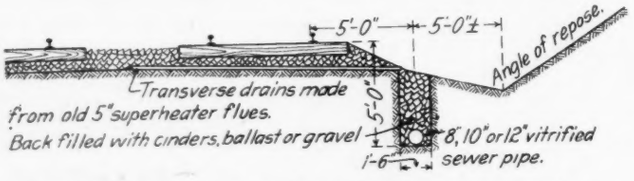
expense of the improvement will, therefore, be met by the saving in maintenance during a single season.

As a result of experience with these drains, the practice in a number of details has been definitely established. The pipe is almost always of 12 in. diameter, but if the requirements are moderate a 10-in. size will answer, and in exceptional cases, when the cut is short and not springy, 8-in. is sufficient. As the lateral thrust is considerable, because of the close proximity of the track, nothing but the double strength pipe is proper, and similarly all broken or defective pipes should be carefully culled out. While it is generally desirable that both ditches be equipped, it is not always required.

In most cases of single- or even double-track railroad a series of cross drains of 6-in. iron pipe will render a single longitudinal drain effective.

Blind drains consisting simply of a cinder-filled trench are necessary at intervals to lead the water from the roadbed to the pipes. The same result is also obtained by the use of transverse tubes of small diameter. These tubes need not be larger than 2 or 3 in. in diameter and are most efficient when supplied with numerous perforations. Old superheater tubes, which are about 5-in. diameter, are effective where springs occur in the roadbed. It is possible to drive the tubes into the sub-bed if a pointed plug is first inserted; but the use of an auger is better. As the pipe progresses, the auger is turned in the pipe and this drills a clean hole for the tube.

The most effective location for the drains is 5 ft. from the gage of the rail and this will be, for most standard sections of roadway, also the distance from the pipe to the toe of the slope. Thus the system serves the double purpose of draining the water from the track and receiving that from the springs in the slope. A less distance from the track renders the pipe more liable to fracture from the weight of the traffic, and a greater distance does not fully answer the needs in draining the roadbed. The proper width for the excavated trench along an operated track is 18 in. The usual depth of the bottom of the pipe below the base of rail is 5 ft., although if the grade of the track is level and the cut a long one it is an advantage to establish the highest point of the drain at the middle of the cut. In case no direct means of discharge is available, it is sometimes practicable to establish a sump



Old Superheater Tubes Used for Transverse Drains

by blasting a hole to a depth where loose soil obtains, the hole being filled with stones if necessary.

The pipes are placed generally upon the earth floor, but sometimes upon a floor of boards, and are located on a regular gradient established with a level. The least rate of fall that is practicable is 0.4 per cent. In extremely bad soils there is a possibility of the drain becoming distorted through the unequal pressure, a condition evidenced by a rising of the surface of the ditch. An excavation should be made at once and the regular grade of the pipe restored. This is easily done, and it is especially facilitated by the open joints of the drain.

The opening of the joints is only enough to permit the water to enter freely. This is assured by first inserting the pipe entirely into the bell and then drawing it back ½ in. To prevent the entrance of soil into the pipe a layer of hay or straw is packed about the joints. It is also an advantage to line the sides of the trench with straw and the top of the filling should be similarly protected. The back-filling was at first of pebbles, later of old stone ballast, but is now usually of cinders and stone combined. Where the soil is very wet it will be found that cinders alone make the best filling.

When the drains are being applied it is desirable that the work be done expeditiously, to avoid a rapid deterioration of the surface or a sudden bending out of the line. Where the cut is very bad it may be necessary to confine the work to short sections at a time. If the operation is conducted with care there is no essential danger connected with the work, but it is desirable that the placing of the pipe and at least a partial backfilling of the trench should follow the excavation closely. In every case it is advisable to have all necessary materials close at hand when the operation is begun. It should be understood that the track will require additional maintenance for a period which may be as long as six months, because the water in the roadbed is finding outlets into the new drain.

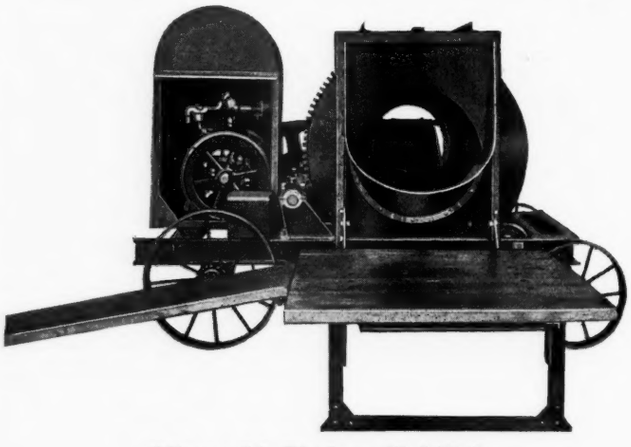
With the narrow gage railway and an equipment of two dump cars, holding 1 1/3 cu. yd. each, the excavated soil can be moved to the end of the cut with one car and the material for back-filling brought in with the other car, these to be alternated in the two operations. A turnout and spur is required in the narrow gage track at the end of the cut. Since the width of the excavated trench is 18 in. and its depth 42 in., it will be found that a car of filling material is required for each 200 ft. of length.

The question will arise as to the propriety of placing these drains on a single- or double-track road that is in time to be laid with additional tracks. The answer is that such a betterment is always in order. While in the case illustrated a saving of one-half in the cost of maintenance was effected, there are places where a saving of nine-tenths is thus accomplished. The drain might in such cases be laid a few inches closer to the existing tracks, so that it would lie in the center line between tracks when the addition was made.

There are points where longitudinal drains have been laid along the center line between tracks with very good results, 3,500 ft. of such drains being in place at three points on the Maryland division. It is preferable in such cases to use the 8-in. size of pipe. The portion of the drain that leads beneath the outside tracks should be laid with iron pipe in place of terra cotta.

A COMPACT CONCRETE MIXER

The Marsh-Capron Manufacturing Company, Chicago, has just added to its list of mixers a portable mixer of one bag capacity, the details of which follow closely the standards of that company's other equipment, but make a special



Mixer with Platform Unfolded

point in this case of the low charging feature. The mixer drum, transmission, clutch, frame and truck wheels are like those of the other mixers of the same make.

The low charging feature is provided by means of a folding platform having a steel frame and wooden top which is 5 ft. long and 4 ft. wide. When down ready for use it is only 19 in. above the ground and when not in use it folds compactly in a vertical position against the side of the mixer drum. The charging hopper is also arranged conveniently. It is only 10 in. above the top of the platform and is 30 in. wide. The opening into the drum is 26 in. in diameter, an opening of this size being permissible because the arrangement of the blades in the drum is such as to insure against slopping.

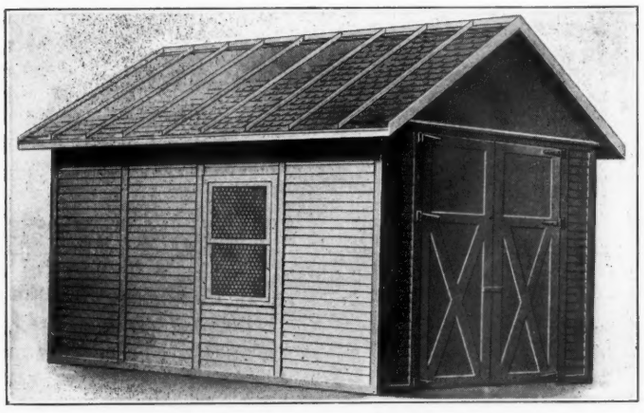
The discharge hopper is of the apron type and the batch

can be emptied in a few seconds. The diameter of the discharge opening is 17 in. Power is furnished by a 4 h. p. vertical type gasoline engine located on one end of the frame and securely housed in a sheet metal cover.

The mixer has a capacity of 7 cu. ft. of mixed material, standard wet batch rating, the overall height is 56 in., the length 7 ft. 9 in., and the width 5 ft. 6 in. The mixer weighs 2500 lb. without the platform, and 2700 lb. with it. As seen from the accompanying photograph, the arrangement is particularly compact and convenient.

THE MECCO METAL TOOL HOUSE

The Mecco metal tool house offers a solution for the fire prevention problem as applied to tool houses for track forces. The house is metal throughout, consisting of galvanized iron sheathing supported on a structural steel framework. There are also wire glass windows in metal frames and a metal door. These houses are designed as portable, in that all parts are arranged for ready erection with no other tools

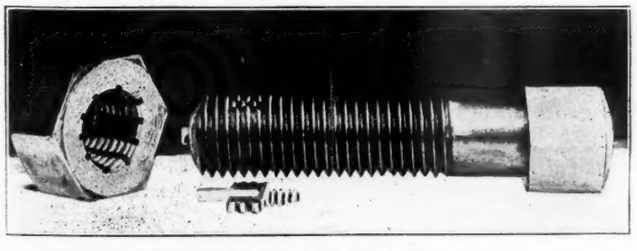


A Metal Tool House

than those necessary for placing bolts and nuts and for anchoring the sills to the foundation. In consequence experienced workmen are not necessary for the erection of the houses, particularly with the detailed instructions furnished by the manufacturer. Although taking only a few hours to erect, the completed house shown in the illustration forms a rigid, permanent structure. These houses are manufactured by the Moeschl-Edwards Corrugating Company, Covington, Ky.

A NEW NUT LOCK

A nut lock of novel design has recently been put on the market by Schum Brothers, New York. This nut lock does not depend upon friction or spring action, but affords a positive lock against the nut turning on the bolt. It consists of



Parts of the Positive Nut Lock

the usual nut and bolt, the nut being slotted across the threads at 10 or more points equally spaced. The bolt is provided with a transverse slot entirely through it, about three threads long and with a width of about one-fifth the diameter. Into this is fitted a small block, which is threaded on its outer surfaces to conform with the threads of the bolt. It fits the sides of the slot snugly, but is half a thread shorter lengthwise, so that it is permitted a limited longitudinal movement. When it is moved to the extremity of the slot nearest the head of the bolt, the threads are lined up, but when moved to the other extremity they are out of alinement.

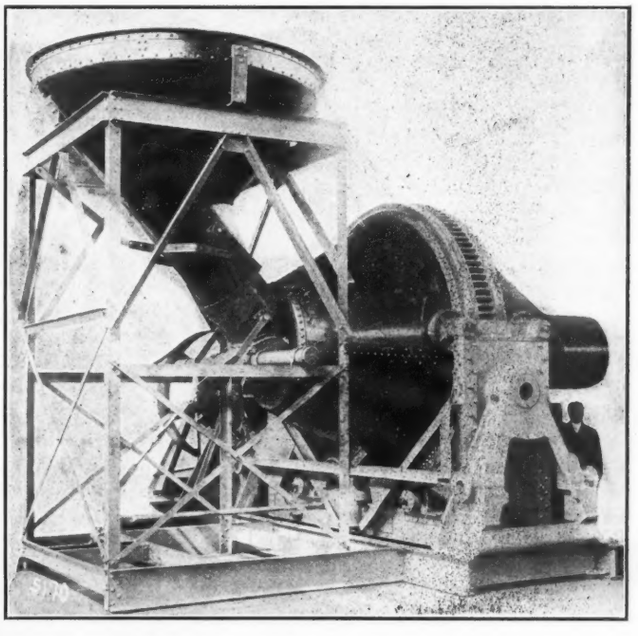
The center of the bolt at the end is drilled to receive a plunger which forms part of the threaded block. A pressure on this plunger serves to move the block up to aline the threads, and when the pressure is released it permits a small spring on the inner end of the block to force it to the other extremity of the slot.

In use the pressure is applied on the plunger until the threads are in alinement, and the nut is turned onto the bolt. When the nut has been fully turned up the pressure on the plunger is released. A further slight turn of the nut brings the block opposite one of the slots in the nut, and the spring forces it into this slot with a click. This forms a positive lock.

To unlock the nut, the pressure is again applied to the plunger until the threads are again in alinement and the nut may then be turned off or turned up tighter, as desired.

LARGE CONCRETE MIXERS

The accompanying photograph shows one of two large concrete mixers recently completed by the T. L. Smith Company, Milwaukee, Wis., for the Hardaway Contracting Company, Washington, D. C. Each mixer has a capacity of 108 cu. ft. of mixed concrete per batch, or approximately twice as much as any of the mixers used in the construction of the



The Largest Concrete Mixer

Panama canal. The mixers weigh 46,000 lb. each, complete with skids and charging hopper. The drums are 9 ft. 6 in. in diameter and are made of ⅜-in. steel. These mixers are to be used on a contract requiring the pouring of 60,000 cu. yd. of concrete per month.

No Coal for Spanish Railways.—Press despatches report that the Southern Railway, which serves a large section of southern Spain, has notified the government it has been compelled to suspend service on account of lack of coal.

Steam Shovels and Locomotive Cranes

Discussion of Their Maintenance and Operation in Railway Service With Measures to Secure Maximum Output

By L. K. Sillcox
Mechanical Engineer, Car Department, Illinois Central, Chicago, Ill.

There are many instances when it is necessary and desirable to know the exact practical results obtained with various types and classes of special machinery. This is especially true with the selection of steam shovels and locomotive cranes.

The type of steam shovel generally used in the United States and Canada for general heavy contract work is the 70-ton machine carrying a 2½-cu. yd. dipper. Forty- and 50-ton shovels are economical for small roads or companies wishing to standardize on a general type of machine, on account of their compact construction and their ability to swing through an arc of 260 deg. Besides this, the smaller shovels are built to handle light materials where small cars must be used. For tunnel work they are provided with special short booms and are often equipped for operation with compressed air. Several types of 70-ton shovels are in use which may be separated into two classes—quick operating for light materials, and slow operating for heavy duty. The two heavy-duty types generally used are identical as regards output, but experience indicates that considerable care is necessary to obtain a shovel of balanced design.

When the dipper becomes stalled it should be possible to have the engines so proportioned that they shall not continue to operate until some portion of the rigging fails, unless a highly experienced operator is present. From a practical standpoint this is a serious mechanical defect and has not received the attention it should. The construction details of the larger sizes of booms on heavy-duty machines should be considered. Proper arrangements should be made with the manufacturer to insure that repair parts will be kept in stock and obtainable upon immediate notice and that such parts shall be made to the same templates as those used for the original machine. Unless this is done, continual delay will result. It is good practice to scrap all chains after they have developed five breaks. Swinging cables should be renewed on an average of every eight weeks. The boom or dipper arm crowding engine bed should be made from cast steel, as continued service will cause ultimate failure unless this is done.

Delays in shovel operation are almost invariably caused by failure to keep cars running in sufficient number to supply the shovel. Except in cases of extremely short haul, shovels will dig more material than can be handled. Dipper teeth should be maintained in good condition and replaced as often as necessary. A sharp case-hardened steel point five inches wide formed as an integral part of a solid manganese cast steel base will give as good service as can be obtained.

A most lamentable fact is the lack of foresight on the part of some who do not put their shovels in thorough repair before a season's work. It usually costs about $40 a month to keep a locomotive in repair, and under the same circumstances a shovel cannot be maintained during the same period for less than $175. This in itself is an indication of the wear and tear which a shovel must withstand. A great saving of expense and time can be accomplished by maintaining a blacksmith in a pit to handle the running repairs to shovels, locomotives and cars. It is necessary to see that water is provided for all boilers. A good system is to have a pipe line run through the pit for the use of shovels, in preference to syphoning from locomotives, as this wastes valuable time. For early and late work a suitable electric-lighting outfit should be provided, including both arc and incandescent lights. Such an outfit costs about $700, but will increase the efficiency of the plant immeasurably.

Where shovel operation is to be carried on with maximum efficiency, it is absolutely necessary to give the superintendent in charge adequate authority. He should be in charge of the pit with absolute control of all engine and train crews. All orders and instructions should be transmitted through him only, and it is well to select a man having mechanical experience, as well as a knowledge of track and ballast work. When it is considered that the cost of operating a pit amounts to approximately $200 per day for every shovel in use, it will be understood that ballast trains should have preference over freight traffic or other inferior service. Unless this is done the output of a pit is severely curtailed. A 70-ton shovel working normally should handle between 1,500 and 2,000 cu. yd. of material, with a consumption of 3,500 lb. of coal and 3,400 gal. of water. A form of daily steam shovel report is given below.

An experienced timekeeper is essential to the most efficient operation of a pit. He should have charge of all supplies and be allowed a trust account to purchase material on the ground, if a net saving can be realized, which is generally the case in outlying districts where vegetables, meat, butter, etc., can be procured locally at almost half the expense of procuring them at large centers, besides saving unnecessary handling and transportation expense.

A. b. & c.Ry.

Report No. 11. BALLASTING (Ballast Pit) Mile 98
(Main Line Cut)
DAILY REPORT STEAM SHOVEL NO. 2036 (Borrow Pit) Stn. 195
Date May 17, 1915.

Force Report	Men	Hours	Distribution of Daily Exp.		This Work	This Month
Supt.	1	10	Loading Material	$61.54	Loaded Flat	Flat
Walking Boss			Hauling Material	23.71	Today 200	200
Foreman 1st	1	10	Unloading Material	12.75	Previous 1400	1400
Foreman 2nd	1	10	Laying Pit Tracks	23.10	Totals 1600	1600
Foreman 3rd	4	45	Perm. Track: Lift	172.44	Shovel is now at Station 196	
Laborers	136	1415	Perm. Track:Lining	21.72	MONTHLY EXPENSE TO DATE	
Engine Crews	6	84	Water Service	3.75	Previous Reports	$4053.80
Train Crews	6	90	B. & . Shop	7.16	Add this Report	618.30
Shovel Crews	4	55	Rental:Engines	30.00	Total to date	$4672.10
Pump Men	1	15	Rental:Ballast Cars	23.75	ENGINES IN SERVICE AT:	
Cable Men	4	45	Cooling Engines	2.70	No. 106 arrived Apr.15/15. Left-	
Lidgerwood Men	1	15	Cooling Shovels		No. 608 arrived Apr. 15/15.Left-	
Car Repairers	1	12	Cooling Ballast Cars	3.60	No. arrived Left-	
Blacksmiths	2	24	Cook Car Crew	9.98	Material unloaded at No.96,97 & 98	
Carpenters			Extra Work as below		200 cars from Stn. 181 to 191	
Cook Car Crews	4	40	Supt.	8.40	- cars from Stn. - to -	
Bridgemen			Office	7.20	- cars from Stn. - to -	
Timekeepers	2	20	Coal used, 16 tons at $6.50	104.00	First Lift Stn. - to -	
			Oils and sundries	2.50	Second Lift Stn. 180 to 186	
Total	174		Total This Date	$518.30	Final Lift Stn. 181 to 183	

Remarks. John Doe

Obtain Form No. 46 for all extra work done
Always report by mile and station.
If filling trestles, report mile and station.

Daily Report for Steam Shovel Work

For new work it has been found advisable on some work to use 6-cu. yd. dump cars, following with 36-ft., 30-ton flat cars with aprons, run in trains of 25 cars each. For general service 40-ton cars fitted with swinging side doors and collapsible ends are most serviceable. These are operated in trains of 22 cars each. A 60-ton unloader mounted on a flat car, complete with a canopy and 900 ft. of 1½-in. ballast cable secured to an all-steel unloading plow forms the complete equipment in conjunction with a standard 50-ton, all-steel ballast spreader.

When considering the purchase of locomotive cranes of 20 tons capacity or less, it is well to have them designed for a wide range of service, but with all types of 50 tons capacity

and greater it is generally assumed that they shall be maintained in regular auxiliary service and stationed in an assigned district.

Locomotive cranes for wrecking and auxiliary outfits are of the 8-wheel type, ranging from 60 to 125 tons capacity with a maximum radius of the main block of about 25 ft. and a minimum of 16 ft. and are designed to operate in fast passenger service. It has been found advisable to use standard axles, journal boxes, wedges, etc., in order to facilitate repairs. The body should be at least 22 ft. long to have good riding qualities and at least one swivel truck should be furnished to allow the car to pass around sharp curves in terminals and elsewhere.

To increase the capacity of these large cranes it is best to have them fitted up with outriggers. This adds to the width of the base and augments the stability of the outfit when operating at right angles to the track. Sliding I-beam outriggers are preferable to the bracket type on the side of the car. They should be used on both sides of the crane when handling heavy loads on poor track, as the breaking of the hoisting cable or the slipping of the hitch sometimes causes the crane to lurch forward. The outriggers should be located as low as possible, so as not to require much blocking and should be operated with ratchet and lever. Jack screws for outriggers are not necessary.

In some designs of cranes when they are swung around at right angles to the car body, that portion of the crane house which contains the boiler may be too heavy, and therefore will not counterbalance evenly with the boom. In consequence the car is canted to the side opposite the boom, and when a lift is taken the car will tend to right itself by lowering the boom. If for any reason the connection between the boom cables and the material to be lifted is broken, it allows the boom to fly up quickly for a couple of feet. While this does not constitute a great disadvantage it is one that the men operating the machines must take into consideration and it compels them to be more careful.

One of the most important features is the fastening of the crane to the car. The uplift on the center hold-down apparatus or king pin is great and subject to severe shocks. In case of failure there is nothing to prevent the crane from leaving the car body on some types of cranes, but with most of the standard makes, it has been found that where accidents of this class occur the roller base affords enough stability to swing the crane house around and permit the movement of the crane to the terminal for repairs. All car bodies for cranes should be of steel and of such length that the boiler end of a crane cannot extend beyond the end of a car, thus permitting the car to be coupled up for train service. The boiler should be designed for hard service, of ample proportions, well insulated and a good steamer. It should be provided with a mud ring instead of having the inside and outside fire box sheets connected by a taper joint, which allows mud to collect and cause leaks. The fuel and water capacity should be as great as possible.

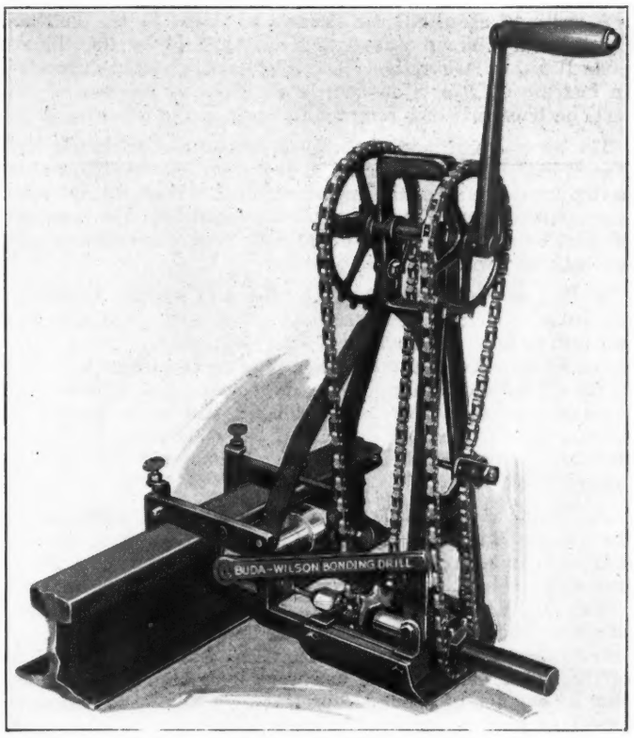
The propelling gear should be designed for operation from 5 to 10 miles per hour with the full load. The throw-out gear should be operated entirely by levers and hand wheels or other suitable means without having to resort to the removal of collars or other fastenings under the car. A good draft rigging and foundation brake gear are essential and it has been found that it is very useful to have emergency brake valves located at diagonal corners on the face of the side sill of the frame, to be operated from the ground. These are used in picking up wrecks and often prevent the crane from being moved beyond the end of the track as the operator can control the movement of a train within a very few inches, which is not possible if the air brake is to be controlled entirely from the locomotive, which may be some distance away. A reversible engine is very useful when lowering a heavy load. High capacity cranes should be fitted up with a suitable device to take the load off the springs when the crane is working to its capacity. This device should be designed to allow the car to ride reasonably well if it is found impossible to release it before the crane is put back in train service.

Wire cables of plow steel composed of 6 strands of 19 wires each with hemp centers are the best lifting medium and are preferable to chains, which are very liable to fail under extremes of temperature especially in cold weather. Cables can be cushioned for auxiliary outfits and when so equipped cause practically no damage to passenger train cars.

THE IMPROVED BUDA-WILSON BONDING DRILL

The Buda Company, Chicago, has just brought out the Buda-Wilson bonding drill, superseding the "Hyduty" Wilson drill, which incorporates a number of new features. One of the important improvements is the addition of a rail clamp in place of a foot plate, holding the drill rigidly to the rail. The rail hooks and clamps are adjustable to enable them to be used with different sizes of rails and to compensate for rail wear. The adjustments of the hook and the clamp are made by means of four thumb set screws.

There are two points of contact between the clamp and the rail, the clamp being operated by two cams by means of a hand lever on the left side of the drill. The drill can be detached from the rail quickly by throwing the hand lever over and releasing the cams. The features embodied in the original Wilson drills for advancing the bit to and returning it from the rail by disengaging the drive sprocket are retained in the new drill. The frame is of malleable iron, strongly reinforced. The weight of the drill is 31 lb.



The Buda-Wilson Bonding Drill

This drill is equipped with the Buda "Hyduty" clutch and spindle to enable twist bonding bits with round shanks and flattened sides to be used. This eliminates the set screw to hold the bit. The hexagonal clamping sleeve is screwed down on the spindle by hand and tightened by a wrench, forcing the clamping block against the flattened side of the bit and holding the bit firmly in place.

General News Department

The machine shop and roundhouse of the Southern Pacific at Naco, Sonora, were destroyed by fire April 10; estimated loss, including damage to three locomotives and two passenger cars, $300,000.

The Chicago, Milwaukee & St. Paul during the past week operated a "Good Roads" special train through Iowa, starting from Ottumwa on April 12. The itinerary included about 35 cities and towns.

In the United States District Court at Louisville, Ky., April 13, the Illinois Central was fined $500 for violations of the safety appliance act. In a similar suit at Houston, Tex., April 11, the International & Great Northern was fined $100.

The New York assembly on April 20 passed the Thompson bill, authorizing the electrification by January 1, 1919, of the New York Central Lines on the west side of the Borough of Manhattan in New York. The bill has passed the senate, and now goes to the mayor for his approval.

A strike of about 400 car cleaners employed by the Pullman Company at Chicago was settled on April 14 by the Illinois State Board of Arbitration. The employees, who had demanded an increase of 2 cents an hour, were given an increase of 1½ cents an hour, and they returned to work on the following day.

The general chairman of the Brotherhood of Locomotive Engineers on the Union Pacific is quoted in the newspapers as having announced that the enginemen of that road will not take part in the concerted movement of the enginemen and trainmen on western roads for the so-called eight-hour day and time and one-half for overtime.

W. G. Lee, president of the Brotherhood of Railway Trainmen, has issued a circular of instructions to all lodges and members in which he says: "Our members would disregard all public statements to the effect that aribitration is being considered by either of the organizations parties to the movement. It is evident from press reports that have been published that some interest is endeavoring to cause the public and our membership to believe that arbitration will be accepted. Nothing of the kind is contemplated."

An effort has been made to effect a permanent organization of the Chicago Railroad Fellowship Club, which has been meeting informally at monthly luncheons during the past winter. Meetings thus far have been held under the auspices of the Railroad Young Men's Christian Association. The attendance has consisted of chief clerks, office employees and representatives of the various departments of the Chicago roads with a fair sprinkling of the higher officers. The luncheons have been well attended with an average of about 175 present each time; and addresses have been given on railroad and other topics.

The Bureau of Foreign and Domestic Commerce of the Department of Commerce announces that it plans to hold an examination in May for the position of special agent to investigate the markets of South America for railway supplies. The date for the examination has not yet been set. The salary of an appointee to this position will not exceed $10 a day for each day in the year; actual transportation expenses and an allowance for actual subsistence expenses not to exceed $5 per diem will be paid. Application to take this examination should be made direct to the Bureau of Foreign and Domestic Commerce, Washington, D. C., and should set forth the applicant's education, and his experience in the subject of the investigation.

The Southern Railway is ready to serve the government in short order should the country be involved in a state of war. The Eleventh Cavalry was to be moved recently from Fort Oglethorpe (Chattanooga, Tenn.) to the Mexican border, and the order for the movement was given at 2 a. m. By breakfast time a sufficient number of cars had been assembled at the fort for loading the heavy equipment, and by four o'clock in the afternoon the first section was made up and ready to depart. The trains were run on special schedules, making stops only for feeding and watering the horses, and covered the distance of 1,463 miles to El Paso in about sixty-nine hours (21 miles an hour), or sixty hours actual running time. There were 122 cars, including 27 tourist sleeping cars and 52 stock cars.

Charles S. Mellen, former president of the New York, New Haven & Hartford, has sued the railroad company in the Supreme Court, New York City, for $138,222.89, of which sum $60,000 is for two years' pay under the agreement by which Mr. Mellen, after his resignation as president, in 1913, was to hold himself in readiness at all times, for five years, to confer with the directors to give them the benefit of his information about the affairs of the company and to give advice. The balance of the gross sum named in the suit is to cover expenditures made by Mr. Mellen in various actions which were begun during the time that he was president, and subsequently. A copy of the agreement was filed in court with the complaint.

A Letter From a Small Investor

Howard Elliott, president of the New York, New Haven & Hartford, makes public the following letter, received by him from John F. Miller, 2296 Amsterdam avenue, New York City:

"For the past 23 years I have worked in the grocery business from fourteen to fifteen hours a day. And all the money I have saved in that time, about $6,000, I have invested in different railroad stock in the United States. It now looks to me as if the railroad employees are going to take my life savings from me and my family. Since the government is undertaking to protect the shippers of merchandise and the traveling passengers, I now believe it is up to the government to protect the people that have invested their hard earned savings in railroads."

St. Louis Railway Club

At the annual election of the St. Louis Railway Club, April 14, M. Marea, general superintendent of the St. Louis, Troy & Eastern, was chosen president for the ensuing year; M. O'Brien, first vice-president; W. S. Williams, second vice-president; J. A. Somerville, third vice-president; B. W. Frauenthal, secretary, and C. H. Scarrett, treasurer.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, date of next or regular meetings, and places of meeting of those associations which will meet during the next three months. The full list of meetings and conventions is published only in the first issue of the Railway Age Gazette for each month.

AIR BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York Next convention, May, 2-5, 1916, Atlanta, Ga.

AMERICAN ASSOCIATION OF FREIGHT AGENTS.—R. O. Wells, Illinois Central, East St. Louis, Ill. Next meeting, June 20-23, 1916, Cincinnati, O.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—W. E. Jones, C. & N. W., 3814 Fulton St., Chicago. Next convention, May 22-24, 1916, Hotel Sherman, Chicago.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Building, Chicago. Annual meeting, June 19, 1916, Atlantic City, N. J.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting June 27 to July 1, Hotel Traymore, Atlantic City, N. J.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Chas. Warren Hunt, 220 W. 57th St., New York. Regular meetings, 1st and 3d Wednesdays in month, except July and August, 220 W. 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York. Spring meeting, April 11-14, Hotel Grunewald, New Orleans, La.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—E. R. Woodson, Rooms 1116-8, Woodward Bldg., Washington, D. C. Annual meeting, June 28, 1916, Hotel Statler, Detroit, Mich.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS.—George W. Lyndon, 1214 McCormick Bldg., Chicago. Semi-annual meeting with Master Car Builders' Association. Annual convention, October, 1916, Chicago.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—Willis H. Failing, Terminal Station, Central of New Jersey, Jersey City, N. J. Next meeting, May 17, 1916, Hotel Traymore, Atlantic City, N. J.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Jos. A. Andreucetti, C. & N. W., Room 411, C. & N. W. Sta., Chicago. Semi-annual meeting, June 16, Hotel Denis, Atlantic City, N. J.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Soo Line, 112 West Adams St., Chicago. Annual meeting, June 20-22, 1916, St. Paul, Minn.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 75 Church St., New York. Next meeting, June 27-28, Boston, Mass.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk, P. O. Box 7, St. Lambert (near Montreal), Que. Regular meetings, 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal, Que.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 176 Mansfield St., Montreal, Que. Regular meetings, 1st Thursday in October, November, December, February, March and April. Annual meeting, January, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawlor Ave., Chicago. Regular meetings, 2d Monday in month, except June, July and August, Hotel La Salle, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Regular meetings, 2d Friday in January, May, September, and November. Annual meeting, 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

CINCINNATI RAILWAY CLUB.—H. Boutet, Chief Interchange Inspector, Cin'ti Rys., 101 Carew Bldg., Cincinnati. Regular meetings, 2d Tuesday, February, May, September and November, Hotel Sinton, Cincinnati.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—Elmer K. Hiles, 2511 Oliver Bldg., Pittsburgh, Pa. Regular meetings, 1st and 3d Tuesday, Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Traffic Manager, R. F. & P., Richmond, Va. Annual session, May 17, 1916, Washington, D. C.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—A. M. Hunter, 321 Grand Central Station, Chicago. Regular meetings, Wednesday, preceding 3d Thursday in month. Room 1856, Transportation Bldg., Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, 547 W. Jackson Blvd., Chicago. Annual meeting, May 15-18, Hotel Sherman, Chicago.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Annual convention, May 23-26, 1916, Hollenden Hotel, Cleveland, Ohio.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Building, Chicago. Annual meeting, June 14, 1916, Atlantic City, N. J.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting, 2d Tuesday in month, except June, July, August and September, Boston.

NEW YORK RAILROAD CLUB.—Harry D. Vought, 95 Liberty St., New York. Regular meeting, 3d Friday in month, except June, July and August, 29 W. 39th St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—E. N. Frankenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings, 3d Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, 410 Masonic Temple Bldg., Peoria, Ill. Regular meetings, 3d Thursday in month, Jefferson Hotel, Peoria.

RAILROAD CLUB OF KANSAS CITY.—Claude Manlove, 1008 Walnut St., Kansas City, Mo. Regular meetings, 3d Saturday in month, Kansas City.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Room 207, P. R. R. Sta., Pittsburgh, Pa. Regular meetings, 4th Friday in month, except June, July and August, Monongahela House, Pittsburgh.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, N. Y. C. R. R., Box C, Collingwood, Ohio. Annual meeting, May 15-17, 1916, Hotel Statler, Detroit, Mich.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 2136 Oliver Bldg., Pittsburgh, Pa. Meetings with Master Car Builders' and Master Mechanics' Associations.

RAILWAY TELEGRAPH AND TELEPHONE APPLIANCE ASSOCIATION.—G. A. Nelson, 50 Church St., New York. Meetings with Association of Railway Telegraph Superintendents.

RICHMOND RAILROAD CLUB.—F. O. Robinson, C. & O., Richmond, Va. Regular meetings, 2d Monday in month, except June, July and August.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, 2d Friday in month, except June, July and August, St. Louis.

SALT LAKE TRANSPORTATION CLUB.—R. E. Rowland, David Keith Bldg., Salt Lake City, Utah. Regular meetings, 1st Saturday of each month, Salt Lake City.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant Bldg., Atlanta, Ga. Regular meetings, 3d Thursday, January, March, May, July, September, November, 10 A. M., Piedmont Hotel, Atlanta.

TOLEDO TRANSPORTATION CLUB.—Harry S. Fox, Toledo, Ohio. Regular meetings, 1st Saturday in month. Boody House, Toledo.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEWARK.—Roy S. Bushy, Firemen's Bldg., Newark, N. J. Regular meetings, 1st Monday in month, except July and August. The Washington, 559 Broad St., Newark.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 291 Broadway, New York. Regular meetings, last Tuesday in month, except June, July and August, Waldorf-Astoria Hotel, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Gen't Agt., Erie R. R., 1924 Oliver Bldg., Pittsburgh, Pa. Meetings, bi-monthly, Pittsburgh.

TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library Bldg., St. Louis, Mo. Annual meeting in November. Noonday meetings, October to May.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7122 Stewart Ave., Chicago. Next convention, June, 20, 1916, Toronto, Ont.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, Superintendent's Office, N. Y. C. R. R., Detroit, Mich. Meetings monthly, Normandie Hotel, Detroit.

UTAH SOCIETY OF ENGINEERS.—Frank W. Moore, 1111 Newhouse Bldg., Salt Lake City, Utah. Regular meetings, 3d Friday in month, except July and August, Salt Lake City.

WESTERN CANADA RAILWAY CLUB.—L. Kon, Immigration Agent, Grand Trunk Pacific, Winnipeg, Man. Regular meetings, 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Regular meetings, 3d Tuesday in month, except June, July and August, Grand Pacific Hotel, Chicago.

WESTERN SOCIETY OF ENGINEERS.—E. N. Layfield, 1735 Monadnock Block, Chicago. Regular meetings, 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings. Annual meeting, 1st Wednesday after 1st Thursday in January, Chicago.

Traffic News

The Panama canal was reopened for traffic April 15, and 16 ships passed through on the first day, 7 northbound and 9 southbound.

The Railroad Commission of Tennessee has issued an order by virtue of which the reduction of passenger rates on the Illinois Central, to the basis of 2½ cents a mile, recently ordered by the commission, will not be put in effect until July 1 next.

A special meeting of the traffic officers of the southwestern railroads was held at St. Louis last week to consider the readjustment of rates to Louisiana and Texas made necessary by a fourth section order of the Interstate Commerce Commission, which was to become effective on May 1. The commission, however, has extended the time to February 1, 1917.

The latest agricultural demonstration train to be announced consists of no less than 13 cars; it is that of the combined expedition of the agricultural colleges of Utah and Nevada, and is managed by the traffic department of the San Pedro, Los Angeles & Salt Lake. The train started from Salt Lake City recently for a three weeks' trip. The train carried 10 lecturers, experts on as many different subjects.

On Monday of this week the New York, New Haven & Hartford announced the lifting of embargoes against Naugatuck, Waterville, Bristol and New Britain; but it has been necessary to put a new embargo on shipments from the Central of New Jersey. The New Haven will accept freight for export, under certain conditions, when vessels are ready for the freight and when the shipment is made in time to allow delivery at dock in good season. Restrictions on freight to be delivered in New York harbor by lighter were removed by the New Haven on April 18. At Chicago embargoes have been much modified and freight is moving East quite freely. There is a large movement of grain to Baltimore, Newport News and Philadelphia. The movement of empty freight cars westward is reported in many quarters as quite satisfactory.

Car Surpluses and Shortages

The American Railway Association committee on relations between railroads, Arthur Hale, chairman, in Statistical Statement No. 15 gives a summary of freight car surpluses and shortages for April 1, 1916, with comparisons as follows:

Total Surplus—	
April 1, 1916	46,921
March 1, 1916	43,025
April 1, 1915	327,441

The surplus for March 1, 1916, shown above, includes figures reported since the issue of Statistical Statement No. 14.

There has been very little change in the total surplus since March 1. Almost one-half of the box car surplus is in the Southeast, and the larger part of the surplus coal and miscellaneous cars are on the Pacific coast and in the Northwest, no large number of surplus cars of any class in any other one section:

Total Shortage—	
April 1, 1916	43,271
March 1, 1916	62,562
April 1, 1915	357

The shortage for March 1, 1916, shown above, includes figures reported since the issue of Statistical Statement No. 14, published in the *Railway Age Gazette* of March 17, page 518.

The total shortage shows a reduction of approximately 19,000 since March 1. This is the largest shortage reported for the same period since 1907. The largest box car shortages are in the Northwest and in C. F. A. territory. The largest coal car shortage is in the East.

The figures by classes of cars follow:

Classes	Surplus	Shortage
Box	11,349	28,858
Flat	4,442	726
Coal and gondola	13,646	8,669
Miscellaneous	17,484	5,018
Total	46,921	43,271

Commission and Court News

INTERSTATE COMMERCE COMMISSION

Lumber to Stations on the St. Paul

Opinion by Commissioner Hall:

The commission finds unjustified a proposed cancellation of joint through rates on lumber from producing points on the Chicago & North Western in Minnesota, Wisconsin and the upper peninsula of Michigan to points on the Chicago, Milwaukee & St. Paul in Minnesota, North Dakota, South Dakota, Iowa and Missouri. (38 I. C. C., 587.)

Stone from Illinois Points

Opinion by the commission:

The commission finds that the New York Central has justified increased interstate rates on crushed stone, riprap and rough stone, not dimension or dressed, on rubble and on black dirt and quarry strippings in straight or mixed carloads from Kankakee, Lehigh and West Kankakee, Ill., on the Illinois division to various grouped points in Illinois and Indiana on the Big Four and the Lake Erie & Western. Some of the increases allowed, however, are not as great as the new tariffs proposed. (38 I. C. C., 389.)

Rates on Lumber from Bonners Ferry, Idaho

Bonners Ferry Lumber Company v. Great Northern. Opinion by the Commission:

The Commission finds that the rates on lumber in carloads from Bonners Ferry, Idaho, to points on the Great Northern in Montana east of Dunkirk and south of Naismith are discriminatory as compared with rates from Libby and Eureka, Mont., to the same points of destination. A proper relationship of rates is prescribed for the future.

Rates on lumber in carloads from Bonners Ferry, Idaho, to points in North Dakota and Minnesota are also found unreasonable and discriminatory as compared with rates from western Montana lumber-producing points to the same destinations, and reasonable nondiscriminatory rates are likewise prescribed. (38 I. C. C. 268.)

Reconsignment of Grain and Grain Products

Commercial Exchange of Philadelphia v. New York Central et al. Opinion by Commissioner Meyer:

By tariffs effective on about December 1, 1914, the principal trunk line railroads imposed a charge of $2 a car for diversion in transit or the stopping at "hold" points, and the subsequent forwarding of carload shipments of flour, grain, feed, hay, straw and some other commodities. The shipments move from central freight association and points west, and are finally delivered at points in eastern Pennsylvania, New Jersey, New York, New England, and to some extent in the south. The freight is usually "slip-billed" from its point of origin to some point east of the hold point, with instructions to hold at some designated hold point. In some cases the shipper is able to determine the final destination of the car before it reaches the hold point, and to have it "diverted" before it reaches that point. In other cases the car is held at the hold point, and is then "reconsigned."

This method of handling cars has been in use since about 1887, and was originally much like a rebate for certain shippers. At first the service was free, but since 1907 a charge of $2 has been made for reconsignment.

The commission holds that the service is a necessary one. It finds that the charge of $2 for reconsignment is not unreasonable, but that a charge of $2 for diversion would be excessive. A charge of $1 per car, however, is allowed.

Commissioner Harlan in a concurring decision says: Reconsignment and diversion are examples of what are described in the Industrial Railways Case, 29 I. C. C., 212, and in The Five Per Cent Case, 31 I. C. C., 350, as special services for which the carriers should make a charge; and, although not so stated in the foregoing report of the commission, the charges for those services here under consideration were established by the defendant carriers, as the record shows, in conformity with the commission's suggestions in the latter proceeding. In both cases it was held that every service rendered by a carrier should be made to contribute reasonably to its earnings; and in the application of this principle by the commission in this case I fully concur. It is indeed to be regretted, in the general public interest, that the constructive course respecting such matters, pointed out in The Five Per Cent Case, has not had more definite support by the commission in other subsequent proceedings, fully heard upon carefully prepared records involving measures taken by the carriers to conserve their revenues in the manner recommended by the commission itself in that case. . . .

With respect to the specific charges now exacted by these defendants for services long performed by them for a few shippers without charge it remains only to be said that while reconsignment doubtless may justify a higher charge than diversion, nevertheless the $2 charge now imposed by the carrier for the latter service is not excessive in my judgment; to restrict the charge to $1, as here is done by the commission, does not in my view adequately measure the cost or the value of the service.

Another concurring opinion by Commissioner Clements with which opinion Commissioner Clark agrees, speaks of the criticism of the commission's course with reference to charges for special services, as follows: . . . It is my view that the only question lawfully before the commission for decision in The Five Per Cent Case was the reasonableness of the proposed increased rates there under suspension. If this view is correct, the various suggestions contained in the report in that case were at most in the nature of *obiter dicta*. In any event I submit that the proposition can not be maintained that tariffs filed in consequence of those suggestions proposing new or increased charges or rates for what may be alleged to be special or additional services have any different standing under the law than like tariffs filed without reference to any suggestions contained in the commission's report in that case. They are all subject to suspension and investigation; or, if not suspended, subject to complaint; and in either case the duty is imposed upon the commission to investigate and determine their reasonableness upon the record made thereon without any tinge or degree of prejudgment. . . . (38 I. C. C., 551.)

Absorption of Switching Charges at Boston, Mass.

National Dock & Storage Warehouse Company v. Boston & Maine. Opinion by Commissioner McChord:

The commission finds prejudicial the Boston & Maine's practice of absorbing switching charges of connecting lines to and from Commonwealth pier, owned and operated by the state of Massachusetts, while refusing to absorb switching charges of connecting lines to and from complainant's dock. It therefore holds also that the carrier has justified a proposed discontinuance of absorption of switching charges of connecting lines to and from Commonwealth pier, and of wharfage charges at that pier.

The piers of the National Dock & Storage Warehouse Company are in East Boston. They are adjacent to the docks of the Boston & Albany, and are reached only over the rails of that carrier. The Commonwealth dock is adjacent to the piers of the New York, New Haven & Hartford in South Boston, and is reached only by that carrier.

For many years prior to 1913 it was the practice of all the roads entering Boston to absorb the switching charges to and from the docks of connecting lines on import and export freight moving to or from territory west of the Hudson river, and, broadly speaking, beyond New England and immediately contiguous territory on the north; but on such freight moving to or from points within those limits, constituting the greater portion of the tonnage, the connecting line switching charges were collected in addition to the Boston rate. Thus it results that import freight for Boston & Maine territory ordinarily is handled at the docks reached directly by that carrier. Such shipments as arrive at the National dock destined to Boston & Maine territory must be hauled by the Boston & Albany to East Somerville, a distance of about 6 miles, for delivery to the Boston & Maine. For this service the usual charge of the Boston & Albany is 2½

cents per 100 lb., or 50 cents per ton; and the freight must still pay the full Boston rate to destination.

As to freight arriving at Commonwealth pier, destined to Boston & Maine territory, the practice is different. For transporting freight between Commonwealth pier and the Boston & Maine terminal, about 6 miles distant, a joint switching charge of 60 cents per ton is published, of which 20 cents accrues to the Union Freight Railroad and 40 cents to the New Haven, the division to the latter including the service of loading or unloading at the docks. The Commonwealth pier charges 10 cents per ton for wharfage, and storage on freight after 6 days. The charge of 60 cents per ton for switching cars containing 6,000 lb. or more and 80 per cent of the wharfage is absorbed by the Boston & Maine on import and export freight moving to or from points within the territorial limits before described. This absorption is provided for in a contract between the Boston & Maine, the New Haven, and the state of Massachusetts, through the directors of the port of Boston, dated July 1, 1912, whereby the carriers agreed to apply the Boston rate, so far as they legally might, to all freight to and from Commonwealth pier.

When the National Dock Company complained that this arrangement resulted in discrimination, the Boston & Maine proposed to withdraw the absorption on shipments to Commonwealth pier. The Supreme Court of Massachusetts has issued a temporary injunction, however, forbidding the carrier to discontinue the absorptions under the contract with the state. The commission holds, as noted above, that the present arrangement is prejudicial to complainants as alleged. It finds further that if the Boston & Maine has to absorb the charges on traffic originating on its lines in New England, the rates it will receive will be unreasonably low for the service performed. It is also influenced in its decision by the fact that the contract entered into with the state was made when the New Haven and Boston & Maine were in the same hands, whereas now the latter road is independent, and it appears that the contract would have helped the New Haven at the expense of the Boston & Maine. Concerning the fact that Commonwealth pier is owned by the state, it says: "Under the law we can give no weight to the fact that the practices are the subject of contract or to the fact that Commonwealth pier is owned and operated by the state, except in so far as those facts may have evidential bearing upon the characteristics of the rates and practices of the carriers and may assist in defining their status under the act." (38 I. C. C., 643.)

UNITED STATES SUPREME COURT

Interstate Shipment's Character Not Changed by Consignee's Payment of Freight

It has been decided by the Supreme Court of the United States that an interstate shipment does not lose its interstate character, so as to be governed by the state law, although the entire freight charges have been paid by the consignee, and part or the whole of the shipment has been permitted to remain to meet the consignee's convenience in removal.

The action was brought in the South Carolina state courts to recover for the loss by fire in the railroad's warehouse of nine boxes of shoes, part of an interstate shipment of thirteen boxes, of which four had been removed by the consignee, who had paid the entire freight, and had been permitted to leave the nine boxes for his convenience. The position of the railroad company was that the shipment had not lost its interstate character; that the provisions of the bill of lading were controlling; that the defendant's liability as warehouseman was governed by federal law; and that the burden was on the plaintiff to show negligence. The South Carolina Supreme Court, deciding the railroad's liability as warehouseman according to the state law (placing the burden of showing want of negligence on the railroad), affirmed a judgment for the plaintiff (99 S. C., 422). The Supreme Court of the United States has now reversed this judgment. Mr. Justice Hughes delivered the opinion, saying in part: "The question is whether this admitted transaction had the legal effect of discharging the contract governed by federal law, and of creating a new obligation governed by state law.

"By the Act to Regulate Commerce (sec. 1) the 'transportation' it regulates is defined as including 'all services in connection with the receipt, delivery, elevation and handling of property transported.' All charges made for any service rendered in such transportation must be just and reasonable. No carrier shall extend to any shipper or person any privileges or facilities in 'the transportation'—that is, as defined—'except such as are specified in such tariffs.' The bill of lading provided that 'every service' to be performed under it, including the service of the terminal carrier, should be subject to the conditions specified, and among these was the express condition governing the company's responsibility as warehouseman for property not removed within 48 hours after notice of arrival. Such a retention of the goods was undoubtedly a terminal service forming a part of the 'transportation' in the sense of the federal act and governed by that act. . . . It is also clear that with respect to the service governed by the federal statute the parties were not at liberty to alter the terms of the service as fixed by the filed regulations. . . . It is apparent that there had been no actual delivery of the nine boxes. The payment of the freight had no greater efficiency than if it had been made in advance of the transportation." The railroad company, as warehouseman only, was liable only in case of negligence, and the loss by fire being undisputed, the plaintiff had the burden of establishing the neglect. The "somewhat exceptional" rule of the South Carolina courts that "the burden of showing that there was no negligence is on the defendant," to which the South Carolina Supreme Court adheres, "notwithstanding the great number of opposing authorities in other jurisdictions" (76 S. C., 248), was therefore held not to apply, because the railroad's obligation was not governed by the state law. Decided April 10, 1916.

COURT NEWS

A. K. Hunt, former railroad conductor of Dallas, Texas, filed a suit in the United States District Court at Chicago on April 13, against the General Managers' Association at Chicago, asking that the organization be dissolved as an organization in restraint of trade, alleging that it maintains an age-limit rule which prevents railroads from hiring employees over 45 years of age, and that it maintains a personal record, which is used "to control the labor market of the United States." He also asks damages to the amount of $50,000 because he has been refused employment. Railroad officers asserted that the association has nothing to do with the age-limit rule which is maintained by some roads.

The order of the United States District Court for the northern district of California, annulling the order of the Interstate Commerce Commission, prescribing rates on freight from the east to Pacific Coast terminals, was this week suspended by the Supreme Court of the United States, which directed a stay of proceedings until the decision of the lower court can be reviewed. This action was taken on application of the Department of Justice. The action of the commission was in pursuance of its decision in the long drawn out intermountain rate cases, in which the Supreme Court upheld the right of the commission to divide the country into zones, and approved its modification of the long and short haul rule. Rates lower than the maximum were allowed on a large number of articles to nine cities on the Pacific Coast—the Pacific Coast terminals. But the railroads were not satisfied, and they applied to the California District Court to enjoin their enforcement. This was passed upon favorably, and the government has now appealed to the Supreme Court. The judges in the lower court held that they had no authority to keep the rates in effect pending appeal.

Lost Ticket—Right to Eject

In an action for insulting language by a conductor and unlawful ejection, it appeared that the plaintiff bought a ticket at Greenville, S. C., for Gastonia, N. C. He checked his baggage and entered the train. Just after the train had left Greenville the ticket collector asked for his ticket. He replied he could not find it. The collector went on through the car, telling the plaintiff to look for it and he would come back for it later. When the collector returned the plaintiff told him he had lost the ticket. The collector took him to the conductor, who told him he would have to produce the ticket, pay the cash fare or get off. The plaintiff testified that he showed the collector his baggage check, and told him that, if he had not had a ticket, he could not have checked his baggage; and that the collector said: "There are enough dead beats now." All this was denied by the defendant's witnesses. After the plaintiff was put off the

train, he found his ticket in his pocket. There were two questions in the case: (1) Did the defendant have the right to eject the plaintiff? (2) If so, did it have the right to eject him as a "dead beat"?

The first question the South Carolina Supreme Court answered in the affirmative. The great weight of authority holds that when a passenger loses his ticket, he is entitled to a reasonable time to find it, and, failing to find it, he must pay cash fare or get off the train. If this were not the rule, one ticket would always do for two. The passenger who bought the ticket could not be put off, because he had paid his fare. It would not even be necessary to show collusion, or that there should be collusion, because the passenger, after he had bought and paid for his ticket, and checked his baggage on it, might have dropped it and another could have found it. Whether the conductor used the language described, and whether it was abusive, was for the jury to decide. Judgment for the plaintiff was reversed.—Adams v. Southern (S. C.), 87 S. E., 1,006.

No Duty to Light Flag Stations

The Virginia Supreme Court of Appeals holds that a railroad company is not bound to furnish a light at a passenger shed, placed at a flag station at which trains did not usually stop and passengers were not expected. Therefore it is not liable for injuries due to the absence of a light, received by one alighting at such place in the nighttime.—Mitchell v. Southern (Va.), 88 S. E., 56.

Inspection of Cars by Consignees

Hay was shipped under bills of lading prohibiting inspection unless provided by law, or permission was endorsed on the bill or given in writing by the shipper. In an action for breach of this stipulation by the railroad, the North Carolina Supreme Court holds that a circular letter sent out by the shippers stating that they guaranteed grade and weight and billed all cars "inspection permitted" was sufficient to permit inspection.—Elm City Lumber Co. v. A. C. L. (N. Car.), 88 S. E., 139.

Injuries to Persons on Right of Way

A person using a path on a right of way four or five feet from the ends of the ties, which had been used as a pathway by the public for over 25 years, was injured by an iron pipe which swung out or was thrown from a passing train. The Kentucky Court of Appeals holds he was not entitled to recover from the railroad company under the doctrine of acquiescence in use of the path by the public imposing the duty to use reasonable care to prevent injuries, in the absence of evidence that the injury was produced by affirmative or positive acts of negligence in causing the iron to fly or be thrown from the train. The acquiescence doctrine is applicable only where the path used is on the track or so near that persons using it are in danger of being struck by moving trains.—L. & N. v. Marlow (Ky.), 183 S. W., 470.

Provisions of Lease as to Preferential Rates

Under its lease for 999 years of the Lehigh Coal & Navigation Company's line, the Central of New Jersey agreed to pay as rental a stated sum annually, and also to give to the mining company certain advantages in rates over other shippers in the same region by charging it only the rates in force from a designated point. After the enactment of the Hepburn Amendment, the railroad attached a note to its tariffs, setting out the requirements of its lease, and thereafter, while charging the mining company schedule rates from points of shipment, as it did other shippers, it returned a portion of such charges in monthly settlements. In proceedings for violating the interstate commerce law, the railroad contended that these monthly allowances were a mere convenience in accounting, in order to ascertain what amount of revenue the leased lines were producing; the mining company being entitled to receive one-third of the revenue under the lease. The Circuit Court of Appeals, Third Circuit, held that such allowances were not for the use of an instrumentality of commerce furnished by the mining company, since by the lease the defendant became for all practical purposes the owner of the road, and that on the enactment of the Interstate Commerce Act, and especially section 1, as amended by the Hepburn Act, section 2, the allowance became illegal as a rebate. The fact that the railroad made the payments in good faith and in the belief that they were not prohibited by the act was held to be no defense to a prosecution for its violation.—Central of New Jersey v. United States, C. C. A., 229 Fed., 501.

Injury to Passenger in Aisle

In a passenger's action for injuries there was evidence that numerous grips were in the aisle of a coach for a time sufficient for the trainmen to have discovered and removed them from the aisle, as they testified it was their duty to do; that the train was running about 20 or 25 miles an hour, and suddenly slackened as the plaintiff was walking along the aisle; that he was thrown forward and struck a grip, throwing him down; and that, when he was getting up, the train again started at its usual speed, again throwing him down. The Springfield (Mo.) Court of Appeals held that these facts, if true, showed a breach of the carrier's duty, in view of the high degree of care which a common carrier owes to a passenger.—Abernathy v. Lusk (Mo.), 182 S. W., 1,049.

Construction of Station—Commission's Order and Ordinance

An order of the Florida Railroad Commissioners required the construction at St. Cloud of a station of stated dimensions at a stated place, the building to be of wood. An ordinance of the municipality forbade the construction of other than brick, stone or other fireproof material. This ordinance the railroad company brought to the attention of the railroad commissioners as a reason for not complying with the order. In a suit by the commissioners, the Florida Supreme Court held that the order would not be enforced by mandamus, as the effect of the ordinance on the order had not been considered by the commissioners in determining the reasonableness of the order.—State v. A. C. L. (Fla.), 70 So., 941.

Impairment of Obligation of Contract as to Taxes

In 1826 the Baltimore & Ohio acquired a charter from the state of Maryland which exempted it from taxation. It subsequently built a branch under acts passed in 1890, 1896 and 1906 imposing a capitation tax. The state was interested directly in the construction of the branch and bought stock for its building. The company paid the capitation tax until it accepted the act of 1878, imposing in lieu thereof a gross earnings tax. The state sued to require the company to pay taxes on its gross receipts in the state for the years from 1896 to 1908, over and above the amounts already paid, or the difference between the amount of such tax as fixed by the act of 1878 and the rates established by the acts of 1890 1896 and 1906. The Court of Appeals of Maryland holds that the act of 1878 was a contract between the state and the company so far as it related to the branch, and the company could not be compelled to pay the other taxes imposed by the subsequent statutes.—State v. B. & O. (Md.), 96 Atl. 696.

Telegraph Lines on Rights of Way

A telegraph company which maintained its poles and wires along a railroad's right of way under a contract for 25 years sought to condemn that portion of the right of way for such use. The Alabama Supreme Court holds that section 5817 of the Alabama Code, which granted rights of way for telegraph lines along the margins of public highways does not, in connection with Const., 1901, section 242, declaring railroads not constructed and used exclusively for private purposes to be public highways, give a telegraph company an easement along a railroad right of way. The constitutional section was only intended to make railroads highways in a limited sense, and subject them to state and federal control, not to deprive them of their private ownership of their rights of way; and section 3867 of the Code, providing that property already devoted to public use shall not be taken for a different character of use, unless an actual necessity for the specific land or portion thereof shall be alleged and proved, does not authorize a telegraph company to condemn an easement for its lines along the unused portion of a railroad right of way, merely because it is more convenient to do so, or because the easement can be secured at less cost.—L. & W. v. Western Union (Ala.), 71 So., 118.

Railway Officers

Executive, Financial, Legal and Accounting

David S. Jones, whose appointment as assistant to the president of the Buffalo, Rochester & Pittsburgh, with headquarters at Rochester, N. Y., has already been announced in these columns, was born on November 21, 1871, at Plymouth, Pa., and was educated in the common schools of his native town, also at Wilkes-Barre, Pa., and at Wyoming Seminary, Kingston. He entered the service of the Buffalo, Rochester & Pittsburgh in May, 1893, as a stenographer in the freight traffic department. Three years later he was transferred to the transportation department, and in March, 1905, he was appointed chief clerk to the general superintendent. The following year he was made chief clerk to the general manager, and in 1910 was appointed chief clerk to president, which position he held at the time of his recent appointment as assistant to the president of the same road, as above noted.

Operating

C. H. Beatty, general superintendent of the Trona Railway at Trona, Cal., has resigned.

L. R. Huntley has been appointed car accountant of the Evansville & Indianapolis, with office in the Rea building, Terre Haute, Ind.

R. McNamar has been appointed trainmaster of the Evansville & Indianapolis, with office at Terre Haute, Ind., effective on April 10.

C. W. Van Horn, trainmaster of the Baltimore & Ohio at Chicago Junction, Ohio, has been appointed assistant superintendent of the Pittsburgh division, in charge of the territory from McKeesport to Willow Grove, with headquarters at Pittsburgh, Pa.

C. D. Baker, trainmaster of the Long Island Railroad at Jamaica, N. Y., has been appointed superintendent, with office at Jamaica, vice J. B. Austin, Jr., resigned, to go into other business. Mr. Baker entered the service of the Long Island in 1891 as a clerk in the car record office. He was gradually promoted through various positions until 1909 when he was appointed passenger trainsmaster, in charge of all the electrified lines. In 1912 he was detached from the Long Island Railroad and served for six months as a member of a special committee looking into the possibilities of the electrification of the suburban lines of the Pennsylvania Railroad radiating from Broad street station, Philadelphia. In 1913 he was made trainsmaster of the Long Island, with supervision over all train operations, which position he held at the time of his recent appointment as superintendent of the same road, as above noted.

C. D. Baker

Traffic

C. H. McNair has been appointed general agent of the Gulf Coast Lines, with office in the Pierce building, St. Louis, Mo., effective April 15.

S. E. Dusenbury has been appointed commercial agent of the Central of Georgia, with office at Rome, Ga., vice C. S. Pruden, resigned to engage in other business.

S. L. Peeples has been appointed commercial agent of the Central of Georgia, with office at Memphis, Tenn., vice G. M. Rowell, resigned to engage in other business.

J. R. Melville, chief clerk in the office of the vice-president in charge of traffic, of the Grand Trunk at Montreal, Que., has been appointed a general agent of the passenger department at Toronto, Ont.

Herbert A. Jackson, recently appointed general traffic manager of the Great Northern Pacific Steamship Company, was born at Toronto, Ont., on January 6, 1869. He received his education at Upper Canada College, and entered railway service in 1894 as traveling freight agent of the Great Northern at Duluth, Minn. From July 12 to December 1, 1896, he was contracting freight agent of the same railroad at Spokane, Wash.; from December, 1896, to August 21, 1898, he was traveling freight agent, with headquarters at the same place. He was appointed general agent in August, 1898, with office at Spokane, and on June 13, 1899, was promoted to commercial agent of the Great Northern and general freight and passenger agent of the Spokane Falls & Northern. From October 1, 1905, to August, 1909, he was assistant general freight and passenger agent of the Great Northern at Helena, Mont., and from 1909 to April, 1911, held the same position at Portland, Ore. From 1911 to March, 1916, he was assistant traffic manager with office at St. Paul. His present headquarters are at San Francisco, Cal.

H. A. Jackson

John M. Gross, whose appointment as assistant general freight agent of the Pennsylvania Railroad, with office at Philadelphia, Pa., has been announced in these columns, was born on February 15, 1877, and was educated in the private schools of York, Pa., and at York Collegiate Institute. He entered the service of the Pennsylvania Railroad in April, 1896, as a clerk at the York freight station. The following November he was promoted to billing clerk, and on January 15, 1899, was promoted to freight solicitor in the office of the division freight agent at Baltimore, Md. In March, 1900, he was appointed freight solicitor of the Star Union Line at Baltimore, and in November, 1902, he was transferred to Rochester, N. Y., as agent for the Despatch Lines. The following March he was appointed freight solicitor of the Pennsylvania Railroad and agent of the Star Union Line, at Reading, Pa. One year later he was appointed special agent at Pittsburgh, and in February, 1905, was promoted to division freight agent at Altoona. He was transferred in January, 1909, as division freight agent to Baltimore, Md., and in May, 1912, became division freight agent of the Pennsylvania at Pittsburgh.

J. M. Gross

His appointment as assistant general freight agent at Philadelphia of the same road becomes effective on May 1.

Julien L. Eysmans, who has been appointed general freight agent of the Pennsylvania Railroad, with headquarters at Philadelphia, Pa., as has already been announced in these columns, was born on March 18, 1874, in Brussels, Belgium, and was educated in the public schools of Baltimore, Md. He entered the service of the Pennsylvania Railroad in May, 1891, as a messenger in the office of the division freight agent at Baltimore. From October, 1893, to July of the following year he served as clerk at Washington, D. C., and then returned to Baltimore in the same capacity. From August, 1896, to 1904 he served consecutively as freight solicitor and agent of the Anchor Line at Baltimore, Md., freight solicitor at Reading, Pa., and district freight solicitor at Baltimore. On January 1, 1904, he was appointed eastern superintendent of the Star Union Line, at New York, and in February, 1906, was promoted to general freight agent of the Cumberland Valley Railroad. He was transferred on June 1, 1911, to Pittsburgh, Pa., as division freight agent of the Pennsylvania Railroad; in May, 1912, he was promoted to assistant general freight agent at Philadelphia, Pa., and on May 1 becomes general freight agent of the same road.

J. L. Eysmans

C. O. Jackson, division passenger agent of the Frisco Lines at Oklahoma City, Okla., has been appointed assistant general passenger agent of the St. Louis & San Francisco & Texas, and the Forth Worth & Rio Grande, with office at Fort Worth, Tex.

George Dickie Ogden, who has been appointed freight traffic manager of the Pennsylvania Railroad, with headquarters at Philadelphia, Pa., effective May 1, as has been announced in these columns, was born on May 16, 1868, at Homer City, Pa., and was educated at the Indiana Normal School, and at Washington and Jefferson college. He began railway work on June 1, 1887, as freight and ticket agent of the Pennsylvania Railroad at Homer. From October to November, 1890, he served as night yard clerk at the Allegheny city yard, and in November, 1890, became transportation clerk in the superintendent's office of the West Penn division. He was then appointed freight and ticket agent at Butler, and subsequently served as freight agent and yardmaster at McKeesport, and later as freight agent at Harrisburg. On January 14, 1901, he was promoted to division freight agent at Altoona. In June, 1903, he was transferred in the same capacity to Pittsburgh; in March, 1906, he was promoted to assistant general freight agent at the general offices in Philadelphia, remaining in that position until May, 1912, when he was promoted to general freight agent, and now becomes freight traffic manager, with office at Philadelphia. Mr. Ogden's entire service has been with the Pennsylvania Railroad.

G. D. Ogden

Robert H. Large, whose appointment as coal traffic manager of the Pennsylvania Railroad, with headquarters at Philadelphia, Pa., has already been announced in these columns, was born on October 31, 1875, at Philadelphia, and was educated at the Protestant Episcopal Academy, Philadelphia, and at the University of Pennsylvania. He began railway work in 1895 as a rodman in the maintenance of way department of the Pennsylvania Railroad. From 1896 to 1897 he was a clerk in the freight station of the same road at Philadelphia, and then to 1900 filled various clerical positions in the general freight department of the same road. In January, 1900, he was appointed soliciting freight agent of the New York, Philadelphia & Norfolk. From December, 1901, to January, 1903, he served as freight solicitor of the United Railroads of New Jersey, and from January 15 to June 1, 1903, as special agent of the Buffalo & Allegheny Valley division of the Pennsylvania Railroad, and agent of the Anchor Line at Pittsburgh, Pa. On June 1, 1903, he was appointed division freight agent of the Pennsylvania Railroad at Altoona, and in February, 1905, was appointed coal freight agent, remaining in that position until June, 1910, when he was appointed general coal freight agent, and now becomes coal traffic manager of the same road, as above noted.

R. H. Large

Robert Clinton Wright, who has been appointed traffic manager of the Pennsylvania Railroad for the lines east of Pittsburgh and Erie, with headquarters at Philadelphia, Pa., as has already been announced in these columns, was born on December 5, 1869, at Rio de Janeiro, Brazil, and was educated in the public schools of Baltimore, Md., and in Baltimore City College. He began railway work in March, 1888, as a messenger and clerk at the Patterson's wharf station of the Northern Central, at Baltimore. From December, 1889, to June, 1897, he served as clerk in the general agent's office at Baltimore, and then to December, 1898, was soliciting agent of the Star Union line. From January 1 to May 1, 1899, he was special agent of the transportation department of the Pennsylvania Railroad, and then to January, 1901, was division freight agent of the same road at Altoona, Pa. He was transferred as division freight agent to Harrisburg in January, 1901, and on June 1, 1903, was appointed assistant general freight agent at Philadelphia. From March, 1906, to May, 1912, he served as general freight agent in charge of local freight. He was then promoted to freight traffic manager, and on May 1 becomes traffic manager for the lines east of Pitts-

R. C. Wright

burgh and Erie, with headquarters at Philadelphia, of the same road as above noted.

A. D. Phillips, general agent, freight department, of the Western Maryland, at Philadelphia, Pa., has been appointed general eastern agent, with office at New York, vice L. F. Klein; and G. J. Davis succeeds Mr. Phillips.

H. H. Brown, assistant general freight agent of the Great Northern at Spokane, Wash., has been promoted to general freight agent, with office at St. Paul, Minn. F. H. Parker, assistant controller, has been appointed assistant general freight agent, vice H. H. Brown, and P. B. Beidelman, general agent refrigerator service, has been appointed assistant general freight agent, vice W. J. Power, resigned. Effective on April 16.

H. A. Fidler, recently appointed general freight agent of the Detroit, Toledo & Ironton, with office at Detroit, Mich., was born at Arendtsville, Pa., on January 12, 1874. He entered railway service on January 2, 1889, in the employ of the Cleveland, Cincinnati, Chicago & St. Louis. He was rate and bill clerk at Danville, Ill., until April 1, 1893; from April, 1893, until August 1, 1895, he was yard clerk for the same road at Danville; from August, 1895, until November 24, 1895, he held a clerical position with the Big Four at Springfield, Ohio. He became receiving clerk of the Ohio Southern freight at Springfield in November, 1895, and remained in that position until December 26, 1895, when he was made rate clerk in the same office. On April 1, 1899, he was appointed claim clerk in the general freight office of the same road, and on November 17 of that year was promoted to chief clerk of the same office. From August 1 to 18, 1900, he was assistant general freight agent, and from the latter date until October 1 was assistant general freight and passenger agent. From October, 1900, to June 1, 1901, he was general freight and passenger agent of the same railroad. He was division freight agent of the Detroit Southern at Springfield, Ohio, from June, 1901, to June 1, 1907, when he became division freight agent of the Detroit, Toledo & Ironton at Ironton, Ohio. On May 15, 1913, he became traffic manager of the Big Sandy & Kentucky River, and on May 1, 1915, returned to the service of the Detroit, Toledo & Ironton, Ohio, as assistant general freight agent.

Engineering and Rolling Stock

H. D. Cameron has been appointed mechanical engineer of the Canadian Northern, with office at Toronto, Ont.

G. K. Galloway has been appointed assistant master mechanic of the Baltimore & Ohio, with headquarters at Glenwod, Pa.

P. L. Drescher has been appointed master mechanic of the Evansville & Indianapolis, with headquarters at Terre Haute, Ind.

J. H. Roach, assistant valuation engineer of the New York Central Lines West of Buffalo, has been appointed valuation engineer, with office at Cleveland, Ohio.

Oscar Culbreth has been appointed road foreman of engines for the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Mt. Carmel, Ill., effective April 16.

A. T. Kuehner has been appointed motive power inspector of the main line district of the Baltimore & Ohio, and E. G. Cromwell has been appointed general foreman at Cumberland, Md.

J. Butler was recently appointed assistant master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis at Bellefontaine, Ohio, instead of master mechanic, as reported in a recent issue. J. Karibo, master mechanic at Mattoon, Ill.; E. J. Buckbee, general foreman of the Mt. Carmel (Ill.) shops, and Z. A. Baird, have not been appointed to different positions as reported.

J. B. Martin, roadmaster of the New York Central Lines West of Buffalo, with headquarters at Adrian, Mich., has been appointed roadmaster of the Elkhart division, with office at Elkhart, Ind., vice John Wirley, retired. T. W. Dempsey, roadmaster of the Ft. Wayne division at Hillsdale, Mich., has been transferred to Adrian, vice Mr. Martin. G. C. McMillen, Jr., roadmaster of the Lansing division at Hillsdale, has been made roadmaster of the Ft. Wayne division, with office at Hillsdale. F. E. Triechman has been appointed roadmaster of the Lansing division, with office at Hillsdale, vice G. C. McMillen, Jr.

OBITUARY

Charles E. Wickham, division engineer of the Delaware, Lackawanna & Western at Binghamton, N. Y., died April 16.

A. F. Brewer, superintendent of the Utah-Montana division of the Oregon Short Line, with office at Pocatello, Idaho, died at Oakland, Cal., on April 17.

John K. Brown, formerly assistant engineer maintenance of way of the Missouri Pacific at Wichita, Kan., died in that city recently. He was born at Greenwich, Ohio, on October 26, 1832, and entered railway service in 1856. He was employed on more than a dozen roads in various parts of the country, being assistant engineer maintenance of way of the Union Pacific when he retired in 1900. He surveyed and helped construct part of the Oregon Short Line, sections of the Missouri Pacific in Kansas, and the Boston, Hartford & Erie in Connecticut.

James F. Walsh, formerly general superintendent of motive power of the Chesapeake & Ohio from May 1, 1910, to July, 1912, died suddenly of apoplexy at the Hotel Roanoke, in Roanoke, Va., on April 13. He was born in March, 1857, at Cleveland, Ohio, and began railway work in 1871 on the Cleveland, Columbus, Cincinnati & Indianapolis, now a part of the Cleveland, Cincinnati, Chicago & St. Louis. From 1871 to 1892 he was consecutively apprentice, locomotive fireman, locomotive engineman and shop foreman. Mr. Walsh left railway work in 1892 to become mechanical expert for the Galena Oil Company, but returned to railway service 10 years later as superintendent of motive power on the Chesapeake & Ohio. In May, 1910, he was promoted to general superintendent of motive power at Richmond, Va., and on July 1, 1912, retired from the active duties of that office, but later served in a consulting capacity on the same road. At the time of his death Mr. Walsh was on a business trip to Roanoke for the Galena Oil Company, with which he was connected.

J. F. Walsh

George C. Arnold, freight claim agent of the Lehigh Valley, died at his home in Philadelphia, Pa., on April 1. He was born in Jamaica in January, 1857, and moved, with his parents, in childhood to the United States, entering railway service in 1874 as a clerk. Later he became traveling auditor of the Ohio & Mississippi, now a part of the Baltimore & Ohio Southwestern. He then served as traveling auditor of the Missouri Pacific, and subsequently was placed in charge of the freight accounts of that road. He then entered the operating department of the St. Louis Southwestern, and later was appointed freight claim agent of the same road. In 1903 he went to the Chicago, Rock Island & Pacific as freight claim agent, and in May, 1905, to the Lehigh Valley, in the same position.

Jesse B. Barton, general attorney of the Baltimore & Ohio Chicago Terminal, at Chicago, died at his home in Hinsdale, Ill., on April 17, at the age of 66. He entered railway service in November, 1885, on the Chicago Great Western, and subsequently did miscellaneous work for the Chicago & Alton, and the Lake Shore & Michigan Southern. In 1880 and 1881 he was one of the attorneys for the Sumpter Valley Railway of Oregon. In 1889 he became general attorney for the Chicago Terminal Transfer Railroad, and in April, 1910, when the Baltimore & Ohio Chicago Terminal took over the property of the Chicago Terminal Transfer, he became general attorney of the latter road, which position he held at the time of his death. From 1891 to 1894, he was also general attorney of the Wisconsin & Michigan and the Lake Michigan Car Ferry & Transportation Company.

Equipment and Supplies

LOCOMOTIVES

THE KANSAS CITY SOUTHERN is said to have placed an order for 10 locomotives. This item has not been confirmed.

THE ALABAMA COMPANY, Birmingham, Ala., has ordered one six-wheel switching locomotive from the Baldwin Locomotive Works.

THE TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS is reported in the market for 10 or 12 eight-wheel switching locomotives.

THE CLEAR LAKE LUMBER COMPANY, Clear Lake, Wash., has ordered one Mikado type locomotive from the Baldwin Locomotive Works.

THE ALAN WOOD, IRON & STEEL COMPANY, Conshohocken, Pa., has ordered one four-wheel switching locomotive from the Baldwin Locomotive Works.

THE PENNSYLVANIA EQUIPMENT COMPANY, Philadelphia, Pa., is in the market for a second-hand Consolidation locomotive, weighing about 130,000 lb.

THE MISSOURI PACIFIC is said to have ordered 14 Santa Fe type locomotives from the American Locomotive Company, in addition to other locomotives recently reported.

THE NORFOLK & WESTERN, reported in the *Railway Age Gazette* of March 31 as about to enter the market for 30 Mallet type locomotives, has ordered 20 Mallet type locomotives from the American Locomotive Company.

THE SOUTHERN is reported to have ordered 8 switching and 6 Mikado locomotives from the Baldwin Locomotive Works, in addition to the 25 Santa Fe and 15 Mountain type locomotives, noted in last week's issue. This item has not been confirmed.

THE SOLVAY PROCESS COMPANY, Syracuse, N. Y., has ordered one superheater six-wheel switching locomotive from the American Locomotive Company. This locomotive will have 21 by 26-in. cylinders, 51-in. driving wheels, and a total weight in working order of 156,000 lb.

THE LONG ISLAND, reported in the *Railway Age Gazette* of March 3 as contemplating the purchase of 6 eight-wheel switching locomotives, has ordered 4 eight-wheel switching locomotive from the American Locomotive Company. These locomotives will have 23 by 28-in. cylinders, 56-in. driving wheels, a total weight in working order of 195,000 lb., and will be equipped with superheaters.

FREIGHT CARS

THE LOUISVILLE & NASHVILLE is reported to have ordered 850 underframes from the Pressed Steel Car Company.

THE PENNSYLVANIA EQUIPMENT COMPANY, Philadelphia, Pa., is in the market for 50 second-hand, 30-ton box cars.

THE LONG ISLAND, reported in the *Railway Age Gazette* of March 24 as being in the market for 15 refrigerator cars, has ordered these cars from the Standard Steel Car Company.

THE UNION TANK LINE, reported in the *Railway Age Gazette* of March 31 as having ordered 750 tank cars from the American Car & Foundry Company, has since increased this order to 1,000 cars.

THE ANACONDA COPPER MINING COMPANY is inquiring for prices on 102 cathode flat cars. Through a typographical error in last week's issue this inquiry was reported as for 2 cars. The company is also in the market for 40 anode rack cars.

PASSENGER CARS

THE SEABOARD AIR LINE, reported in the *Railway Age Gazette* of April 7 as having issued inquiries for 6 dining cars, has ordered 3 dining cars and 2 observation dining cars from the Pullman Company. This order was incorrectly reported in last week's issue as having been placed by the Chesapeake & Ohio.

THE PENNSYLVANIA EQUIPMENT COMPANY, Philadelphia, Pa., is in the market for the following second-hand passenger equipment: One private car; one baggage and express car, and 3 combination passenger and baggage cars, with the baggage compartment in the center of the car.

THE SOUTHERN RAILWAY has ordered 45 coaches, 13 passenger and baggage cars, 19 baggage and express cars, 10 mail and baggage cars, and 5 club cars, from the Pullman Company. This order is for 32 cars more than the 60 in the inquiries mentioned in the *Railway Age Gazette* of March 24. The inquiries included only 25 coaches, 10 baggage and express cars, 5 club cars, 10 passenger and baggage cars, and 10 baggage and mail cars.

IRON AND STEEL

THE WHEELING & LAKE ERIE has ordered 15,000 tons of rails from the Carnegie Steel Company.

THE SOUTHERN RAILWAY has ordered 1,500 tons of bridge work from the American Bridge Company.

THE PENNSYLVANIA RAILROAD has placed orders for 205,000 tons of rails, 125,000 tons for the Lines East of Pittsburgh, and 80,000 tons for the Lines West of Pittsburgh.

THE CHICAGO, ST. PAUL, MINNEAPOLIS & SAULT STE. MARIE has ordered 625 tons of steel for an ore dock at Ashland, Wis., from the Minneapolis Steel & Machinery Company.

THE NORTHERN PACIFIC has divided an order for approximately 16,000 tons of rails among the Illinois Steel Company, the Lackawanna Steel Company and the Bethlehem Steel Company.

THE CHICAGO, ROCK ISLAND & PACIFIC has been authorized by the Federal Court to order 40,000 tons of rails for 1917 delivery. It is understood that the Illinois Steel Company will get the order.

THE GREAT NORTHERN has divided an order for 30,000 tons of rails for delivery this fall and in the spring of 1917 among the following companies: Illinois Steel Company, 15,000 tons; Lackawanna Steel Company, 10,000 tons, and the Bethlehem Steel Company, 5,000 tons.

TRACK SPECIALTIES

THE GREAT NORTHERN has purchased the following track specialties since January 1: 9,592 kegs of track bolts; 15,612 kegs of spikes; 333,690 angle bars, and 1,094,000 tie plates.

THE "DEAD MAN'S HANDLE."—Evidence given before a coroner's jury at Penge (London) recently, when the circumstances attending the death of a motorman on a London, Brighton & South Coast electric train were being investigated, disclosed a disquieting fact. The guard in his evidence stated that the train left the Crystal Palace at 2:42 p. m. and should have stopped at Gipsy Hill, but ran through the station, and, after running a quarter of a mile further, was stopped by the witness. It was then discovered that the motorman was missing, and his body was afterwards found in the Crystal Palace tunnel. Exactly how he came to fall from the train was not determined, but the point that needed investigation was how it came about that the train continued in motion after the pressure of the driver's hand had been removed from the controller. The motor inspector had, he said in his evidence, discovered on the floor of the driver's compartment a small wedge which, he suggested, was used to wedge the controlling handle so that the train would keep running without its being necessary for the driver to keep his hold on the handle, and the witness demonstrated to the jury how this could be accomplished. Such an act on the part of an electric train driver would, of course, constitute a very serious dereliction from duty, but the fact that a means has been devised whereby the supposed security of the "dead man's handle" system can be annulled demands the taking of steps that in future shall make such an act impossible, or at least that its results can have no effect upon the safety of the train and its passengers.—*Railway Gazette, London.*

Supply Trade News

The Stover Engine Works and the Stover Manufacturing Company, Freeport, Ill., will be merged and brought under the control of a new corporation to be known as the Stover Manufacturing & Engine Company. The new corporation will be capitalized at $3,000,000.

As the old Haskell & Barker Company has been succeeded by the Haskell & Barker Company, Inc., the corporate name of the old company has been changed to the Michigan City Car Company to avoid confusion with the new corporation. The old company is being liquidated.

Vulcan Brake Shoe & Equipment Company

The Vulcan Brake Shoe & Equipment Company was incorporated in Delaware, April 3, 1916, with an initial capital of $1,000,000. The company, which is composed of men who were until recently associated with the American Brake Shoe & Foundry Company, will engage in the manufacture of brake shoes and grey iron castings. It will have offices in the Equitable building, 120 Broadway, New York, and works at Baltimore, Md. Its officers are: W. H. McDonough, president; Edward Barrett Smith and R. M. Brower, vice-presidents; F. W. Grant, secretary and treasurer. Robert N. Hill is engineer of tests, and H. K. Schoenheiter, superintendent of the works.

W. H. McDonough

W. H. McDonough, the president of the company, was born in New York City, and was educated at the College of the City of New York. He is a lawyer by profession, but he has been engaged in active commercial work for some years. He was formerly associated with the American Brake Shoe & Foundry Company and an officer in several corporations controlled by interests connected with that company.

E. B. Smith

Edward Barrett Smith, vice-president, was born in New York City, and until his resignation on March 31 had been with the American Brake Shoe & Foundry Company and its predecessors, the Ramapo Foundry Company and the Ramapo Iron Works, for twenty years. When he left to become associated with the Vulcan Brake Shoe & Equipment Company he was in the sales department, specializing in the sale of brake shoes to electric railways and for export trade.

R. M. Brower, vice-president, was born in Riverton, N. J., and was associated with the American Brake Shoe & Foundry Company for eight years. For a number of years he was in the motive power department of the Central of New Jersey. During his first two years with the American Brake Shoe & Foundry Company he was engaged in special work in the engineering and testing departments, and at the time of his resignation on March 31 was connected with the sales department, specializing in the sale of brake shoes to steam railroads.

R. M. Brower

F. W. Grant, secretary and treasurer, was born at East Windsor Hill, Conn. He was with the American Brake Shoe & Foundry Company for nine years. Prior thereto he was connected with the Pope Manufacturing Company for eight years. He entered the services of the American Brake Shoe & Foundry Company in March, 1907, and served successively as chief clerk of the Mahwah (N. J.) plant, chief clerk at the Chicago Heights (Ill.) plant, assistant comptroller in charge of the cost department, and assistant to the vice-president in charge of sales and accounting.

F. W. Grant

Robert N. Hill, engineer of tests, was born in Ontario, Can. He graduated from Cooper Union, New York City, with the degree of electrical engineer, afterwards taking a post-graduate course in mechanical engineering. He was for several years in the engineering department of the Interborough Rapid Transit of New York City, and was five years in the testing and engineering department of the American Brake Shoe & Foundry Company.

H. K. Schoenheiter was born in St. Paul, Minn. He learned the trade of foundryman and machinist with Henry H. Ormes & Sons, of Minneapolis, with which company he was connected for 15 years, seven years of which he was superintendent of the works. The business of this firm was later purchased by the American Brake Shoe & Foundry Company and became known as the Twin City plant. He remained there in charge as superintendent for two years and five years ago was transferred to the company's largest plant at Mahwah, N. J., where he remained until he severed his connection with the organization.

E. S. Cullen, who has been associated with the Niles-Bement-Pond Company as representative for a number of years, has left the services of that company, and has established the E. S. Cullen Machinery Company, with office in the Leader-News building, Cleveland, Ohio, to deal in machine tools and locomotive cranes.

The Standard Scale & Supply Company, Pittsburgh, Pa., will henceforth be represented in Detroit by the Michigan Scale & Supply Company, 82 Woodbridge street. The company will be the direct representative of the Standard Scale & Supply Company in the sale of Standard scales, concrete mixers, etc. The

large volume of business at Detroit and the surrounding territory has made it necessary to have a local connection at that point, so as to give manufacturers, railroad companies, contractors, etc., the benefit of quick deliveries and special services similar to those maintained at other houses and agencies of the company.

As hinted in the recent statement of E. H. Gary, saying that "The subsidiary companies of the United Steel Corporation, who manufacture rails, have decided to maintain the present prices until May 1, 1916, as to rails sold for delivery up to May 1, 1917, but will make no commitments beyond that date," the steel corporation has advanced the price of standard open hearth and Bessemer rails $5 a ton. Several of the independent companies have also announced that they will do likewise. This is the first change in the price of rails in 15 years.

B. A. Clements, western railroad representative of Worth Brothers Company at Chicago, has left that position, and has been elected vice-president of the Rome Merchant Iron Mills. Mr. Clements was born at Indianapolis, October 3, 1877, and after graduation from the public schools of Centralia, Ill., entered the service of the Illinois Central as messenger boy. From 1891 he served successfully as clerk and stenographer to the road-master and superintendent of the Chicago and St. Louis divisions until July, 1898, when he became secretary to the general passenger agent of the Michigan Central at Chicago. In 1899 he returned to the Illinois Central as secretary to the general superintendent of transportation, and from 1902 to 1904 was chief clerk to the general manager. From 1906 to 1909 he was chief clerk to the vice-president in charge of operation, when he was appointed general agent, operating department, reporting to the president. In 1910 Mr. Clements left the Illinois Central to accept the position of western railroad representative of Worth Bros. Company, with headquarters at Chicago. As vice-president of the Rome Merchant Iron Mills, he will have headquarters at 30 Church street, New York.

B. A. Clements

TRADE PUBLICATIONS

Oil Engines.—Fairbanks, Morse & Co., Chicago, have recently issued Bulletins H 178 B and H 192 C, dealing respectively with the Fairbanks-Morse horizontal pattern Type "Y" (Semi-Diesel) oil engine and the company's Type "Y" oil engines, style "V." These engines are made in sizes 10 hp. to 25 hp. horizontal, and 37½ hp. vertical. They burn nearly all of the grades of fuel oil available, and with almost as great economy as the Diesel type of engine. They are simpler in construction and in operation, and lower in first cost. They are adapted for pumping, lighting and power service, and particularly for isolated lighting service.

Interlocking.—The General Railway Signal Company has recently issued Bulletin No. 132, dealing with the G. R. S. system of electro-mechanical interlocking. The booklet describes and illustrates the electro-mechanical interlocking machines, and says that: "The requirements of railway traffic during the past decade have become more and more exacting upon mechanical interlocking systems, and there have been so many electrical accessories—electrically operated signals, various types of electric locking, etc.—added to mechanical interlocking that the present mechanical interlocking machine is, in many cases, inadequate for the control of the electrical units. As a result of this condition there has come into use a combination or electro-mechanical machine."

Railway Construction

Bessemer & Lake Erie.—This company is building a small yard near Greenville, Pa. In addition to the construction of new tracks, the work involves the taking up of some of the existing tracks, a change in the location of the present highway and the construction of a bridge to carry a highway over the yard. The work is being carried out by company forces.

Boston Roads.—The Boston (Mass.) Terminal Commission recommends to the Massachusetts legislature improvements to the railroad terminal facilities in and about Boston, as follows: The construction of a few hundred feet of track to connect the Union Freight Railway with the South Boston yards of the New York, New Haven & Hartford. The construction of a belt line is also recommended by the commission, beginning at a point near Saugus river on the Eastern division of the Boston & Maine, located within a radius of 12 miles from the state house, and terminating at Readville on the N. Y. N. H. & H., to connect with all the railroads entering Boston. The commission has tentative plans made for such a line, and preliminary estimates have been obtained; portions of existing roadbeds could be utilized, and the cost would not exceed $10,000,000. The committee presents drafts of bills to carry out its plans, including one to form a corporation with $100,000 capital to carry out work, under the name of the Metropolitan Belt Line Railroad Company.

Chattahoochee Valley.—A contract has been given to the Nichols Contraction Company, Atlanta, Ga., to build an extension from the present terminus at Jester, Ala., south to Bleecker, which is on the Central of Georgia, about 10 miles, and the work is to be started at once. The company now operates a line from Standing Rock, Ala., south via West Point, Ga., to Jester, Ala., 34 miles. (March 10, p. 463.)

Chesapeake & Ohio.—Regarding the report that a contract has been let to build a branch line from Williamsburg, Va., to the proposed plant of the E. I. du Pont de Nemours & Co., on the York river, an officer writes that the location of this line has not yet been determined. (April 7, p. 817.)

Chicago, St. Paul, Minneapolis & Omaha.—This road will undertake the filling for its yards at Hazel Park, Minn., at a cost of about $100,000.

Erie.—The Robert Grace Construction Company, which has the contract for double-tracking and grade reduction work on this road between Lomax, Ind., and Griffiths, 35 miles, started laying track on April 17. The project involves the handling of 1,250,000 cu. yd. of ballast, and the placing of 20,000 cu. yd. of concrete. Including sidings and double track, 100 miles of track will be laid. A reinforced concrete, pile trestle, 2,000 ft. long, will be built across the Kankakee river. The maximum grade is three-tenths per cent. Seven steam shovels are being used in handling material. L. A. Mullins, 1189 Commercial National Bank building, Chicago, is in charge of the work, for the contractor, under the general supervision of A. F. Hecker, vice-president and general manager, Cleveland, Ohio.

Florida Roads (Electric).—Plans are being made to build an electric line, it is said, from Tampa, Fla., east via Gary and Plant City to Lakeland, about 30 miles. Franchises have already been secured through Gary and Plant City. E. J. Binford, Tampa, is said to be interested.

Gainesville, Weatherford & Southwestern.—Under this name plans are being made to build a line, it is said, from Weatherford, Tex., south via Bridgeport to Gainesville, about 70 miles. W. D. Stratton and C. Sandstrum, Middletown, N. Y., are said to be interested.

Grand Trunk Pacific.—Passenger traffic is now in operation on the Cut Knife subdivision of the Prairie division, between Battleford, Sask., and Carruthers, 46.5 miles.

Kentucky Roads (Electric).—Plans are being made to build an electric line, it is said, from Frankford, Ky., west to Shelby-

ville, about 20 miles. J. W. Cudgell, Shelbyville, and W. W. Lindsey, Detroit, Mich., are said to be interested.

KETTLE VALLEY.—This company expects to open for operation this summer the extension from Brodie, B. C., southwest to Hope, where connection will be made with the Canadian Pacific.

NASHVILLE, CHATTANOOGA & ST. LOUIS.—This company is making improvements consisting of line correction and grade reduction on about two miles near Burns, Tenn. The work is being carried out by company forces.

NEWPORT & ALEXANDRIA INTERURBAN.—The plans of this company call for building an electric line from Newport, Ky., south to connect Licking Pike, Three Mile Creek, Cold Spring, Silvergrove and Alexandria, about 15 miles. The grading work involves handling about 10,000 cu. yd. to the mile. The maximum grade will be 2.5 per cent, and the maximum curvature 12 degrees. The bridges include one 100 ft. span and one 50 ft. span, calling for 125,000 f. b. m. of timber, 650 tons of steel, and the construction of 1,350 cu. yd. of concrete. J. A. Stewart is the engineer, 1113 Traction building, Cincinnati, Ohio.

NEW ORLEANS, MOBILE & CHICAGO.—This company has given a contract to C. G. Kershaw to revise the grade on three miles near Walnut, Miss. About 1.25 miles of new line will be built to replace the existing line; the work will consist of taking out some high hills and building grades.

NEW YORK SUBWAYS.—The New York Public Service Commission, First district, has approved the form of contract for the construction of a portion of the Queensboro bridge line, to be operated by the Interborough Rapid Transit Company. The portion covered in this contract comprises part of the Manhattan approach to the Queesboro bridge and a part of the Queens approach. The commission directed the company to advertise for competitive bids.

NIAGARA, WELLAND & LAKE ERIE (ELECTRIC).—Construction work has been started by this company, it is said, on an extension south to Port Colborne, Ont. The company already operates a line connecting Niagara Falls and Welland.

SOUTH FORK-PORTAGE (ELECTRIC).—This company plans to build an electric railway from South Fork, Pa., east via Summerville and Wilmore, to Portage along the river about 7.5 miles. The work will be carried out by company forces and includes the construction of four steel bridges of 100 ft., 20 ft., 75 ft. and 60 ft. each. It is expected that the line will be completed this summer, 3.5 miles of track having already been laid. The maximum grade is 5 per cent. Robert Pearce, president, and O. P. Thomas, chief engineer; the headquarters of the company are at Johnstown.

SOUTHERN RAILWAY.—Contracts for double tracking the main line between Central, S. C., and Cornelia, Ga., 56 miles, have been let as follows: Central to Seneca, C. J. McKinney, Knoxville, Tenn.; Seneca to Westminster, Robert Russell, Chatham, Va.; Westminster to Tugalo River, Winston & Co., Richmond, Va.; Tugalo River to Toccoa, Rhinehart & Dennis Company, Charlottesville, Va.; Toccoa to Ayersville, C. W. Lane & Co., Atlanta; Ayersville to Cornelia, H. J. Dunavant & Company, Knoxville, Tenn.

RAILWAY STRUCTURES

ASHLAND, WIS.—The Minneapolis, St. Paul & Sault Ste. Marie has awarded a contract to the Minneapolis Steel & Machinery Company for 1,625 tons of steel for an ore dock to be built at this point.

BALDWIN, N. Y.—The Long Island Railroad has plans made for building a new station at Baldwin. The work will not be carried out until the negotiations now pending with the town officers of Baldwin for a strip of land to form part of the site of the proposed station are satisfactorily completed. The cost of the new station will be about $10,000.

BELLEVILLE YARD, TEX.—The Gulf, Colorado & Santa Fe will build a storehouse, oil house and car shed here, all three of which will be one-story frame structures. The storehouse will be 30 ft. by 72 ft., and will have an unloading platform 10 ft. wide, and an open high platform 40 ft. by 60 ft. The car shed will be 250 ft. long, and will cover two tracks; it will be open at the sides, and will be covered by a corrugated iron roof. The oil house will be 20 ft. by 18 ft., and will have an 8-ft. platform. The total cost of the structures will be about $10,000.

CHICAGO, ILL.—The Chicago, Burlington & Quincy is preparing plans for the material improvement of its freight terminal facilities here. Before the present freight houses between Harrison and Polk streets can be removed to make room for the new Union station, temporary quarters must be provided to take care of the road's package freight business. The only available site for a temporary freight house is between Dekoven and Twelfth streets. The Adams Express Company warehouse and the roundhouse situated there are now being razed, and a temporary tandem engine house and a temporary warehouse for the Adams, Great Northern and Northern express companies will be constructed between Maxwell and Fourteenth streets. The temporary structures alone will cost in the neighborhood of $200,000, and will be erected at once. The temporary tandem engine house will be a frame structure 82 ft. by 200 ft.; the express building will be a one-story frame building, with 40,000 sq. ft. of floor space. The temporary freight house will be one-story in height, and 800 ft. long by 62 ft. wide. A 75-ft. turntable will also be installed near the new engine house. It is hoped that work can be started on the permanent freight houses between Harrison and Polk streets by October of the present year. Thus far only tentative plans have been drawn for these structures, which provide for two reinforced concrete buildings, one for inbound freight and the other for outbound business. The former will be triangular in shape, 105 ft. by 750 ft., two stories in height. The latter will be about 63 ft. by 800 ft., three stories high, with the top floor designed for offices and rooms for the filing of office records. About 18 miles of track will be laid in rearranging the yards. The old R. T. Crane Company plant and the warehouses of the Continental Warehouse Company between Twelfth and Wilson streets were removed to allow for the expansion of the yards. The whole project is rendered exceedingly difficult by the fact that all work must be done without interference with the regular traffic of the road.

The Chicago & Alton will remove its freight station from its present site between Van Buren and Harrison streets to a location nearer to the Chicago river between Van Buren and Polk streets. The present site must be vacated to make room for the new Union station, which will be built between Washington and Harrison streets. The plans for the new freight station are as yet in a preliminary stage.

CLINTON, IOWA.—The Chicago & North Western will make extensive improvements on its property here if the city gives it authority by passing the necessary ordinances. A new freight station is contemplated at the corner of Third street and Eighth avenue, with a driveway entrance on Eighth avenue. It will be of brick construction, 40 ft. by 270 ft., and, with the incidental track changes, will cost about $100,000. With the necessary authorization by the city, work will be started on the building this year and completed as soon as possible. A passenger station will be started in 1917 midway between Third and Fourth streets. It will be one story in height, and will have a brick exterior with cut stone trimmings and a tile roof. All modern provisions as to waiting rooms and the latest type of conveniences will be made. Platforms adjacent to the building and an independent platform, with protection sheds, will be included in the improvement. It is also planned to open a new driveway or street back of the station between Third and Fourth streets. The estimated cost of the station is about $200,000.

COLORADO SPRINGS, COLO.—The Atchison, Topeka & Santa Fe is preparing plans for a passenger station here. In addition to the usual depot facilities, provisions are being made for dining room and lunch room accommodations, and some office space.

CRAVENS, TENN.—Regarding the report that the Nashville, Chattanooga & St. Louis will build a bridge and two industrial spurs, near Cravens, an officer writes that this work has not yet been definitely decided upon.

ERWIN, TENN.—The Carolina, Clinchfield & Ohio is building with its own forces a coach shed at Erwin. The structure is to have a steel frame with iron roof; it will be 40 ft. wide by 378 ft. long and 20 ft. high.

HARRISBURG, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis has awarded a contract for the construction of a passenger station here to the J. B. Ford Lumber Company, Harrisburg, Ill. It will be a one-story structure, 40 ft. by 80 ft., with brick and hollow-tile walls, tile roof and concrete floor. Work was begun on the station on April 15. J. B. Hunley, engineer bridges and structures, Cincinnati, Ohio.

HOWELLS, GA.—A contract has been let to the Morrow Transfer & Storage Company, Atlanta, Ga., for new shop facilities to be provided for the Seaboard Air Line at Howells, for both the car and locomotive departments. The improvements will include buildings and necessary revision and addition to the shop yard at this point. The new facilities for the car department will consist of planing mill, lumber shed, wheel and casting platform, wash and locker room, wheel and axle, blacksmith and air brake shop and coach drop pit. The new facilities for the lecomotive department will consist of erecting shop, master mechanic's office, wash and locker room, coal trestle, coal bin, bar iron racks, plate racks, six engine washout pits, and a complete revision of the present machine shop, including steel roof system replacing present wood roof. The new erecting shop for the locomotive department will be a steel frame structure 55 ft. high below the roof trusses. This building will have reinforced concrete siding and metal window sash, providing a very large percentage of light and ventilation. It will be equipped with one 160-ton and one 10-ton electric crane running the entire length of the building. New and modern machinery will be provided for all facilities, and the entire shops at completion will be modern and up-to-date in every particular.

INDIANAPOLIS, IND.—The Pittsburgh, Cincinnati, Chicago & St. Louis will build a new freight terminal at Indianapolis to cost about $1,500,000. Receiving and classification yards with a capacity of 3,500 cars will be provided for Pan Handle and Vandalia interchange, and for freight to and from Indianapolis on both railroads. A terminal for freight locomotives of both roads will be built, and 55 miles of new track will be laid; 600,000 cu. yd. of grading will be done, and 10,000 cu. yd. of masonry laid. A roundhouse, coaling plant, water station, inspection pits, ash pits, sand house, oil house, power house, yard office, scales and interlocking towers will also be built. Property has been bought for the site, and bids on grading and masonry have been asked for. W. C. Cushing, chief engineer, maintenance of way, Pittsburgh, Pa.

MUSKOGEE, OKLA.—The Midland Valley has awarded a contract for the construction of a planing mill and coach repair shop and a machine shop to the Arnold Company, Chicago, Ill. The planing mill and coach repair shop will be a brick and timber structure, 82 ft. by 130 ft., with a saw-tooth roof. The machine shop will be a fireproof building of concrete, brick and steel construction with a saw-tooth roof. The Arnold Company has purchased the machine tool equipment from the Niles-Bement-Pond Company. Whether the Arnold Company will also construct a power plant here is as yet problematical. The cost of the new buildings will be about $160,000.

NORRISTOWN, PA.—The Pennsylvania Railroad proposes to build a new freight station and transfer at Norristown, which will occupy the entire space between Swede and Barbadoes streets, and Lafayette and Washington streets. The new freight station will be used principally for less-than-carload shipments and transfer business. The present freight yard is to be retained as a carload delivery yard.

TACOMA, WASH.—The engineering department of the Chicago, Milwaukee & St. Paul has begun work on plans and specifications for a new passenger depot, which will be built here at a cost of about $250,000.

SIOUX CITY, IOWA.—The Chicago, Milwaukee & St., Paul is considering the erection of a new roundhouse at this point, together with other extensive terminal improvements.

THE DALLES, ORE.—The Oregon-Washington Railroad & Navigation Company recently opened up its new shops at this point. The structures include a 12-stall roundhouse, a 40-ft. by 60-ft. storehouse, a 30-ft. by 40-ft. powerhouse, a 50-ft. by 60-ft. machine shop, and a 95-ft. turntable. (June 25, 1915, p. 1498.)

TOPEKA, KAN.—The contract for the erection of a blacksmith shop for the Atchison, Topeka & Santa Fe has been awarded to Swanson Brothers of this city. (January 28, p. 186.)

Railway Financial News

BANGOR & AROOSTOOK.—The Maine Public Utilities Commission has authorized the Bangor & Aroostoock to issue $2,500,000 5 per cent two-year notes. Of these notes $2,000,000 have been sold, and the proceeds will be used to pay off $1,500,000 one-year notes due May 1, and to pay for yard and terminal improvements at Van Buren, Maine, and for other capital purposes.

BOSTON & MAINE.—The bill which was passed recently by the lower House of the Massachusetts legislature, repealing the act, adopted last year, to provide for the reorganization of the Boston & Maine, was this week defeated, without a roll call, in the Senate. The "Minority Stockholders' Association," which, according to statements issued by the road, consists of an inconsiderable minority of a minority of the stockholders, is said by the Boston papers to have "lobbied hard" for this repeal legislation; but the facts had been fully presented to the senators and the bill was rejected in the upper House after very little discussion.

The holders of more than two-thirds of the preferred stock of the Fitchburg Railroad have given proxies to the committee co-operating in working out the reorganization plan of the Boston & Maine.

CHICAGO, ROCK ISLAND & PACIFIC.—It is announced that Judge Jacob M. Dickinson, receiver, has agreed to take no further steps toward the payment of the debenture bond interest until he has conferred with counsel for the protective committee of the refunding bondholders. In the course of an exchange of telegrams between Judge Dickinson and counsel for the protective committee, the receiver said that earnings and available cash would justify the payment of this debenture interest. The contention of the protective committee's counsel is that this interest should not be paid until the motion for the foreclosure under the refunding mortgage had been acted on.

MINNEAPOLIS & ST. LOUIS.—A press despatch from Minneapolis says that on May 15 the road will be taken over by the new management, and that Charles Hayden, of Hayden, Stone & Co., New York, will become chairman of the board of directors.

NEW YORK, NEW HAVEN & HARTFORD.—J. P. Morgan & Co., the First National Bank and the National City Bank, all of New York, and Lee, Higginson & Co. and Kidder, Peabody & Co., of Boston, have bought from the New York, New Haven & Hartford $25,000,000 one-year 4½ per cent collateral notes. The proceeds of this sale, together with $2,000,000 of current cash will be used to pay off the $27,000,000 one-year 5 per cent notes due May 1. This sale is not underwritten, but the underwriters of the $27,000,000 notes issued last year are being offered the right to purchase the new notes pro rata in proportion to their underwriting of the old notes. The notes are now selling at a premium of ¼.

ST. LOUIS & SAN FRANCISCO.—J. & W. Seligman & Co. and Speyer & Co., both of New York, the reorganization managers for the St. Louis & San Francisco, have declared the plan of reorganization operative, and it is said that two-thirds of the stock has been deposited under this plan. A foreclosure sale is to take place, and it has not as yet been announced in what state the new company will be incorporated. This is the plan which the Missouri Public Service Commission refused to approve of. The voting trustees under this plan are to be Frederic W. Allen, James W. Lusk, Charles W. Sabine, James Speyer, Frederick Strauss, E. V. R. Thayer and Festis J. Wade.

AMERICAN MACHINERY FOR CHILEAN RAILWAY SHOPS.—The American ambassador at Santiago, Chile, reported under the of February 18 that a New York company had secured the contract from the Chilean State Railways for a complete equipment of machinery for the large railway shops that are to replace the various scattered old repair shops now in existence. The contract amounts to approximately $750,000 United States currency.

[ADVERTISEMENT]

ANNUAL REPORTS

THE NEW YORK CENTRAL RAILROAD COMPANY

To the Stockholders of

THE NEW YORK CENTRAL RAILROAD COMPANY:

The Board of Directors herewith submits its report for the year ended December 31, 1915, with statements showing the results for the year and the financial condition of the company.

The New York Central Railroad Company was formed by the consolidation of the following companies:

The New York Central & Hudson River Railroad Company
The Lake Shore & Michigan Southern Railway Company
Geneva Corning & Southern Railroad Company
The Terminal Railway of Buffalo
The Dunkirk Allegheny Valley & Pittsburgh Railroad Company
Chicago Indiana & Southern Railroad Company
Detroit & Chicago Railroad Company
Detroit Monroe & Toledo Railroad Company
Kalamazoo & White Pigeon Railroad Company
The Northern Central Michigan Railroad Company
The Swan Creek Railway Company of Toledo

The consolidation became effective December 23, 1914, but the accounts and records of the constituent companies were continued until December 31, 1914, so that those of this company might commence January 1, 1915.

Following is a condensed balance sheet as of January 1, 1915:

ASSETS		LIABILITIES.	
Road and equipment	$606,475,003.59	Capital stock	$249,590,460.00
Miscellaneous physical property	6,011,894.41	Funded debt	591,446,508.08
Improvements on leased lines	82,942,900.23	Non-negotiable debt	152,359.44
Securities of affiliated companies	224,678,812.27	Loans and advances	111,815,030.23
Securities of other companies	34,312,817.92	Current liabilities	32,805,538.88
Cash and other current assets	69,161,227.63	Deferred liabilities	19,147,800.86
Deferred and unadjusted assets	10,780,976.01	Surplus	29,405,934.57
	$1,034,363,632.06		$1,034,363,632.06

In this, the first report of the company, it seems proper to indicate the extent and character of the property acquired.

The combination of the properties formed a railroad with a main line extending from New York to Chicago, running through the states of New York, Pennsylvania, Ohio, Indiana and Illinois and with important branches in all those states and in the state of Michigan, the total of owned road being 3,525.55 miles and the combined cost of road, equipment and miscellaneous physical property, as carried on the balance sheet, being $612,486,898.00.

In addition to the lines owned by the various constituent companies the new corporation succeeded to leasehold rights over 1,990.86 miles of road of various companies, contract rights over 60.26 miles, trackage rights over 466.08 miles and a proprietary interest in 18/100ths of a mile, making up a total operated mileage of 6,033.08 miles of road. The company leases 9.85 miles of its road for operation by other companies.

During the year the company acquired by purchase the railroad and other properties of the following named lessor companies: The Cleveland Short Line Railroad Company, with 19.64 miles of road, 19.17 of which was double-tracked: the Jamestown Franklin & Clearfield Railroad Company, with 122.05 miles of road, of which 11.08 was double-tracked: The Elkhart & Western Railroad Company, with a road of 12.1 miles: The Sturgis Goshen & St. Louis Railway Company, with a road of 28.92 miles. The capital stock of these four companies, which was owned by The New York Central Railroad Company, was cancelled and the bonded debt assumed as shown in detail in other parts of this report.

The mortgages and extensions of mortgages which the company was required to make in connection with the consolidation have all been executed.

The Refunding and Improvement mortgage of The New York Central & Hudson River Railroad Company has been extended so as to include the railroads formerly of The Lake Shore & Michigan Southern Railway Company and of other constituent companies.

The authorized capital stock of the new company, as stated in the articles of consolidation, was $300,000,000 and in April 1915, by the authority of various State Commissions, the amount was increased by $100,000,000 to be reserved to provide for the conversion of an authorized issue of the same amount of twenty-year six per cent convertible debentures. None of the stock of the new company has been issued except in exchange for stock of the constituent companies, the total amount so issued being $249,590,460, in the hands of 22,270 stockholders in the United States and 2,772 abroad, the average holdings being respectively 104 and 64 shares and the average of the whole approximately 100 shares.

The funded debt of the company has been increased by:

Twenty-year six per cent convertible debenture bonds issued	$100,000,000.00
Bonds of Cleveland Short Line Railway Company assumed	11,800,000.00
Bonds of Jamestown Franklin & Clearfield Railroad Company assumed	11,000,000.00
Bonds of The Sturgis Goshen & St Louis Railway Company assumed	322,000.00
a total increase of	$123,122,000.00

and has been decreased by:

Three-year gold notes of The New York Central & Hudson River Railroad Company of 1912, matured May 1, 1915	$20,000,000.00
Bonds of the Oswego Railroad Bridge Company, matured February 1, 1915	100,000.00
Bonds of the Syracuse Phoenix & Oswego Railroad Company, matured February 1, 1915	175,000.00
Bonds of the Oswego & Rome Railroad Company (first and second mortgage) matured May 1, 1915	747,000.00
Bonds of The Dunkirk Allegheny Valley & Pittsburgh Railroad Company cancelled	2,900,000.00
Bonds of The Terminal Railway of Buffalo cancelled	1,000,000.00
Bonds of The New York Central & Hudson River Railroad Company—Geneva Corning & Southern Railroad cancelled	600,000.00
Payment of installment due on note to New York, New Haven & Hartford Railroad Company	52,400.00
Cancellation of Lake Shore Collateral bonds	400.00
Payment of installments falling due during the year and on January 1, 1916, on the company's pro rata liability in connection with the certificates issued under equipment trust agreements as follows:	
Trust of 1907, installment due November 1915	1,492,884.74
Trust of 1910, installment due January 1915 $1,432,354.46; installment due January 1916 1,432,354.46	2,864,708.92
Trust of 1912, installment due January 1915 $688,398.90; installment due January 1916 688,398.90	1,376,797.80
Trust of 1913, installment due January 1915 $759,581.80; installment due January 1916 759,581.81	1,519,163.61
Boston & Albany trust of 1912, installment due October 1915	500,000.00
a total decrease of	$33,328,355.07

leaving the total funded debt on December 31, 1915, at $681,240,153.01.

On May 1, 1915, the company issued $100,000,000 of its twenty-year 6 per cent convertible gold debenture bonds, in coupon form of $100, $500 and $1,000, and registered form of $1,000 and larger amounts. The indenture regulating the issue bears date April 21, 1915, and was executed by the company and by the Guaranty Trust Company of New York, as trustee. These bonds are convertible, at any time after May 1, 1917 and prior to May 1, 1925, into shares of the common stock of The New York Central Railroad Company at the rate of $105 face value for one share of $100 par value. The company has the right to retire on May 1, 1918, or any semi-annual interest date thereafter, all or any part, not less than $5,000,000, of these bonds at the rate of one hundred and ten per cent of the face value. The proceeds were used to retire $20,000,000 of three-year gold notes of 1912, maturing May 1, 1915: also mortgage bonds assumed by The New York Central & Hudson River Railroad Company on the consolidation of April 16, 1913, as follows: Oswego Railroad Bridge Company $100,000, Syracuse Phoenix & Oswego Railroad Company $175,000, Oswego & Rome Railroad Company $747,000, so that to the extent of $21,022,000 the funded debt of the company was refunded. The remainder of the proceeds was used to discharge various short term notes which had been issued by some of this company's predecessor companies in connection with improvements to their properties.

Under the terms of the consolidation agreement, the holders of the New York Central 3½ per cent gold bonds, Lake Shore Collateral, who had consented to the consolidation, have the right, at any time following the consolidation, to surrender such bonds for cancellation and to receive in exchange a like amount of The New York Central and Hudson River Railroad Company's consolidation mortgage gold bonds, series A, bearing interest at the rate of 4 per cent per annum. Up to the end of the year $60,540,000 par value of these bonds have been deposited and the income account has been charged with an amount equal to the difference in the rate of interest. The exchange of the bonds will commence in February 1916.

By lease dated September 27, 1915, to become effective January 1, 1916, this company leased the railroad and property of The St Lawrence & Adirondack Railway Company and assumed its lease of a portion of the railroad of the Grand Trunk Railway extending from Valleyfield to Beauharnois and its trackage rights over the Canadian Pacific Railway from Adirondack Junction into the city of Montreal. The lease is for the term of twenty-one years at an annual rental of a sum equal to the interest payable on bonds of the lessor, which may at any time be outstanding, payable direct of the holders of such bonds. On the same date a lease of the railroad and property of the Ottawa & New York Railway Company was executed to become effective January 1, 1916 and to continue for the term of twenty-one years at an annual rental of a sum equal to the interest payable on bonds of the lessor, which may be outstanding, payable direct to the holders of such bonds. The line of the Ottawa & New York Railway extends from the international boundary in the St. Lawrence River, near Nyando, to the city of Ottawa, in the Province of Ontario, and connects directly with the Ottawa Branch of the New York Central Railroad. These two leases were made under the authorization and approval of the Public Service Commission of the State of New York, Second District, and of the Canadian Parliament.

The expenditures for improvements on property owned were	$3,058,736.53
There was also added to investment in road, in addition to similar expenses incurred by the constituent companies prior to the consolidation, for organization expenses and for franchise taxes for filing certificates of increase in capital stock	506,371.76
Investment in road has been increased incident to the conveyance of the four railroads noted in a previous paragraph	25,492,831.18
making a total increase in investment in road account of	$29,057,939.47

There was added to the equipment account for owned equipment, including betterments	$2,938,225.96
and for equipment covered by trust agreements, including betterments thereon	1,356,226.94
There was an addition on account of adjustment in connection with the assignment by the Merchants Despatch Transportation Company of its interest in its trust equipment	420,930.00
There was also added to this account to acquire the interest of the New York New Haven & Hartford Railroad Company in the equipment covered by the Boston & Albany Railroad trust of 1912, in consequence of the cancellation of the agreement for operation of the Boston & Albany Railroad	2,985,157.98
	$7,700,540.88
The equipment accounts were reduced by the value of equipment retired	$7,416,126.87
and through an adjustment in connection with the trust equipment of the former The Lake Shore & Michigan Southern Railway Company	84,666.59
	$7,500,793.46
making a net amount of increase during the year in the equipment accounts of	$199,747.42
and a total increase in investment in road and equipment of	$29,257,686.89

The expenditures for improvements on property leased were..	$2,321,672.41
and on miscellaneous physical property investments.....	866,003.74
The net increase, therefore, in property investments, as shown in above items, is.....	$32,445,363.04

(Separate statistics for Boston & Albany Railroad are printed at the end of the full pamphlet report)

SUMMARY OF FINANCIAL OPERATIONS AFFECTING INCOME

The results for the year 1914, as reported by the separate constituent companies, have been adjusted and combined solely for the purpose of providing an approximate basis for comparisons

OPERATING INCOME	1915	1914	INCREASE OR DECREASE
RAILWAY OPERATIONS	5,640.23 *miles operated*	5,640.11 *miles operated*	0.12 *miles*
Revenues	$167,912,333.33	$152,351,589.88	$15,560,743.45
Expenses	109,394,344.71	113,348,422.58	—3,954,077.87
NET REVENUE FROM RAILWAY OPERATIONS	$58,517,988.62	$39,003,167.30	$19,514,821.32
Percentage of expenses to revenues	(65.15%)	(74.40%)	—(9.25%)
Railway taxes accrued.....	$8,324,325.75	$8,080,810.78	$243,514.97
Uncollectible railway revenue	14,927.30	7,895.73	7,031.57
RAILWAY OPERATING INCOME	$50,178,735.57	$30,914,460.79	$19,264,274.78
MISCELLANEOUS OPERATIONS			
Revenues	$6,431.21	$27,415.71	—$20,984.50
Expenses and taxes.....	4,709.24	12,808.64	—8,099.40
NET REVENUE FROM MISCELLANEOUS OPERATIONS	$1,721.97	$14,607.07	—$12,885.10
TOTAL OPERATING INCOME	$50,180,457.54	$30,929,067.86	$19,251,389.68
OTHER INCOME			
Hire of equipment—credit balance	$72,702.33	$903,490.61	—$830,788.28
Joint facility rent income....	2,829,886.90	2,921,576.92	—91,690.02
Income from lease of road...	77,098.04	10,000.00	67,098.04
Miscellaneous rent income...	680,464.11	784,824.48	—104,360.37
Miscellaneous non-operating physical property	409,772.58	352,445.12	57,327.46
Separately operated properties —profit	1,875,607.91	316,536.37*	2,192,144.28
Dividend income	6,961,515.79	7,604,726.39	—643,210.60
Income from funded securities	680,893.00	604,170.47	76,722.53
Income from unfunded securities and accounts	2,969,132.41	1,817,781.66	1,151,350.75
Miscellaneous income	71,798.15	53,385.81	18,412.34
TOTAL OTHER INCOME....	$16,628,871.22	$14,735,865.09	$1,893,006.13
GROSS INCOME	$66,809,328.76	$45,664,932.95	$21,144,395.81
DEDUCTIONS FROM GROSS INCOME			
Joint facility rents.....	$1,094,610.77	$1,418,314.51	—$323,703.74
Miscellaneous rents	699,334.09	497,523.34	201,810.75
Miscellaneous tax accruals...	67,420.69	87,754.32	—20,333.63
Rent for leased roads.....	6,260,647.88	7,226,098.24]	
Interest on funded debt.....	27,073,097.21	22,398,621.72 }	2,652,166.40
Interest on unfunded debt...	3,565,747.16	4,622,605.89]	
Amortization of discount on funded debt	194,799.00	.....	194,799.00
Maintenance of investment organization	7,489.13	2,496.29	4,992.84
Income transferred to other companies	46,470.34	31,936.35	14,533.99
St L & A Railway: rental of leased line	10,000.00	10,000.00	.....
Other deductions	78,238.90	11,334.71	66,904.19
TOTAL DEDUCTIONS FROM GROSS INCOME	$39,097,855.17	$36,306,685.37	$2,791,169.80
NET CORPORATE INCOME..	$27,711,473.59	$9,358,247.58	$18,353,226.01

*Loss in 1914.

From the net corporate income of the year 1915.....	$27,711,473.59
there have been declared four quarterly dividends of one and one quarter per cent each, making a total for the year of five per cent, amounting to.....	12,466,483.75
Leaving to be transferred to credit of profit and loss, as the surplus of the year 1915.....	$15,244,989.84
Balance to credit of profit and loss (free surplus) on January 1, 1915	$29,405,934.57
Additions for year:	
Surplus from operations.....$15,244,989.84	
Sundry deferred credits and adjustments.... 340,979.96	15,585,969.80
	$44,991,904.37
Deductions for year:	
Dividend of one and one-quarter per cent on 2,492,578 shares of capital stock paid February 1, 1915.....	$3,115,722.50
Appropriated from surplus for depreciation reserve	1,138,977.42
Unaccrued depreciation prior to July 1, 1907 on equipment retired during 1915.....	1,441,562.26
Adjustment with N Y N H & H R R Co in connection with Boston & Albany Railroad operating agreement	141,350.89
Cash advances to Clearfield Bituminous Coal Corporation	308,000.00
Abandoned property	618,901.74
Amortization of proportion for years 1908 to 1914 of discount upon first mortgage bonds of Jamestown Franklin & Clearfield Railroad Company	264,000.00
Amortization of proportion for years 1912 to 1914 of discount upon first mortgage bonds of Cleveland Short Line Railway Company	86,295.00
Discount and expenses account issue of refunding and improvement bonds.....	17,114.87
Discount, commission and expenses account N Y C Lines equipment trust certificates of 1913	361.60
Expenses account issue of twenty-year six per cent convertible debentures.....	73,442.41
Charging off various uncollectible accounts and sundry adjustments of accounts.....	371,116.97
Transfer to appropriated surplus account additions to property	8,585.05 7,585,430.71
BALANCE TO CREDIT OF PROFIT AND LOSS (FREE SURPLUS) DECEMBER 31, 1915....	$37,406.473.66

The revenues from railway transportation increased $15,015,112.99 and from incidental operations $545,630.46. The increase in revenue freight moved was 7,381,690 tons. The average haul increased 12 miles and the revenue per ton mile decreased slightly. Train loads averaged 101 tons larger than in 1914 and carloads one ton larger. The freight revenue for the year was $14,195,615.70 more than in 1914. Passenger traffic did not recover from the depression and hence 1,470,667 less passengers were carried than in 1914. Passenger train miles were reduced 2,792,461. There was a small increase in the number of passengers per train mile. The revenue from transporting passengers decreased $303,327.43 and from excess baggage $21,947.49. Trains moving mail and express and milk earned $1,035,899.01 more than in 1914 due to increased traffic and service.

Operating expenses decreased $3,954,077.87 and the ratio of expenses to revenue was 65.15.

The expenditures for maintenance of way and structures were $897,763.61 less than the outlay of the constituent companies in 1914, essentially due to less expense for clearing snow and ice and reduced charges to bridge and building repairs because of the small amount of improvement work in progress.

The expenditures for maintenance of equipment increased $76,557.01, due to increased charges for retirements and depreciation.

Transportation expenses decreased $2,902,499.32, as compared with the outlay for transportation expense in the previous year by the constituent companies. Contributing principally to this was less fuel charges and lower cost of fuel and increased trainload and carload. In freight service there were over 7,000,000 more tons moved with about the same train miles.

The extra crew laws of the various states are still in effect and require an annual expenditure for the employment of extra men in train crews of approximately $700,000. Your officers consider this expenditure unnecessary; using funds which might otherwise be used to good advantage in improving its transportation facilities and its service to the public.

The Pension Department retired and placed upon the pension rolls 270 employees during the year. 160 of these were authorized because of the attainment of seventy years of age, and 110 because of total and permanent physical disability. 144 pensioners died during 1915. The total amount paid in pension allowances was $391,907.12.

Taxes increased $243,514.97 in which is included taxes for the year 1914 on account of The Lake Shore & Michigan Southern Railway Company $105,653.40, Jamestown Franklin & Clearfield Railroad Company $29,794.34 and The Dunkirk Allegheny Valley & Pittsburgh Railroad Company $1,303.14.

In connection with the Grand Central Terminal the work during the year has been mainly of a finishing up character such as laying permanent tracks in place of temporary ones and the construction of permanent platforms, with the result of permitting the placing of columns for supporting overhead buildings. Negotiations have been conducted for the lease and construction of five buildings over the terminal area. The incoming station has been changed by reducing the headroom and converting the space into additional rooms in the Biltmore Hotel, for which lease has been executed at an additional rental based on the cost. The building for the Government Mail Department was completed during the year, including the conveying equipment for the mechanical movement of mail matter to and from the trains in the station. In connection with the completion of this building Depew Place has been opened between 45th and 46th Streets. The Vanderbilt Concourse building at 45th Street and Vanderbilt Avenue was also completed during the year. Work on the incoming station and upper level is deferred owing to business conditions. The new subway station is expected to be completed by the end of the year 1916 and assurances have been received from the New York City authorities that the contracts will be awarded for the building of the bridge over 42nd Street so that it will be completed at the time the subway is put in operation.

In making comparisons between this and the previous year's report there is the factor to be met of the consolidated company's accounts being one company's as against the accounts of three or more constituent companies for the year 1914.

Negotiations are still pending with the Government with respect to the question of increased compensation for carrying the United States mails and parcel post. The subject is now before Congress, and your officers have devoted a large amount of time and effort in an endeavor to reach what they consider a fair conclusion of this important matter.

The rapid increase of traffic towards the close of the year, of which a large amount was export, calling suddenly into use all the equipment and facilities that had been idle during the depression in business, has placed upon your officers and employees an extraordinary burden. They have met the situation most creditably, and acknowledgment and thanks are hereby rendered.

For the Board of Directors,
ALFRED H. SMITH, *President.*

NEW YORK CENTRAL RAILROAD COMPANY

CONDENSED GENERAL BALANCE SHEET, DECEMBER 31, 1915

ASSETS

INVESTMENTS		
Investment in road		$441,384,042.50
Investment in equipment:		
Trust	$82,096,648.44	
Other	112,251,999.54	194,348,647.98
		$635,732,690.48
Improvements on leased railway property		85,264,572.64
Miscellaneous physical property		6,877,898.15
Investments in affiliated companies:		
Stocks	$136,651,233.81	
Bonds	7,765,389.15	
Notes	38,164,673.03	
Advances	8,645,216.59	
Miscellaneous	1,770,000.00	192,996,512.58
Other investments:		
Stocks	$31,128,115.55	
Bonds	1,834,960.87	
Notes	2,780,026.03	
Advances	45.68	
Miscellaneous	262,675.00	36,005,823.13
TOTAL INVESTMENTS		$956,877,496.98
CURRENT ASSETS		
Cash	$33,809,983.33	
Demand loans and deposits	153,000.00	
Special deposits	777,819.88	
Loans and bills receivable	37,993.33	
Traffic and car-service balances receivable	6,699,648.31	
Net balance due from agents and conductors	6,305,096.61	
Miscellaneous accounts receivable	14,192,286.07	
Material and supplies	13,627,165.18	
Interest and dividends receivable	2,715,388.82	
Rents receivable	27,999.69	
Other current assets	308,186.50	78,654,567.72
DEFERRED ASSETS		
Working fund advances	$194,203.90	
Insurance and other funds	339,686.78	
Other deferred assets	145,789.61	679,680.29
UNADJUSTED DEBITS		
Rents and insurance premiums paid in advance	$54,821.30	
Discounts on funded debt unamortized	6,909,028.94	
Other unadjusted debits	2,341,757.24	
Securities issued or assumed—unpledged	12,000.00	
Equipment acquired from lessor companies (per contra)	14,005,103.60	
Securities acquired from lessor companies (per contra)	471,351.00	23,794,062.08
		$1,060,005,807.07

LIABILITIES

STOCK		
Capital stock		$249,590,460.00
LONG TERM DEBT		
Funded debt unmatured:		
Equipment obligations	$46,028,753.01	
Mortgage bonds	359,509,000.00	
Collateral trust bonds	109,914,000.00	
Miscellaneous obligations	165,788,400.00	
	$681,240,153.01	
Non-negotiable debt to affiliated companies	152,789.44	681,392,942.45
CURRENT LIABILITIES		
Loans and bills payable	$22,019,954.50	
Traffic and car-service balances payable	5,755,126.91	
Audited accounts and wages payable	10,103,590.08	
Interest matured unpaid:		
Matured, payable January 1, 1916	$2,381,510.00	
Interest unclaimed	365,295.98	2,746,805.98
Dividend declared, payable February 1, 1916		3,116,646.25
Dividends matured unclaimed		150,746.74
Funded debt matured unpaid		12,790.00
Unmatured interest accrued		5,548,362.41
Unmatured rents accrued		613,617.37
Other current liabilities		2,123,101.12 52,190,741.36
UNADJUSTED CREDITS		
Tax liability		$837,821.00
Insurance and casualty reserves		184,718.02
Operating reserves:		
Equipment	$498,352.30	
Personal injuries reserve fund	28,461.24	526,813.54
Accrued depreciation of equipment		20,274,066.22
Liability to lessor companies for equipment acquired (per contra)		14,005,103.60
Liability to lessor companies for securities acquired (per contra)		471,351.00
Other unadjusted credits		2,459,657.99 38,759,531.37
DEFERRED LIABILITIES		
Miscellaneous		521,652.02
CORPORATE SURPLUS		
Additions to property through income and surplus		$8,585.05
Sinking fund reserves		135,421.16
Total appropriated surplus		$144,006.21
Profit and loss—balance		37,406,473.66 37,550,479.87
		$1,060,005,807.07

MICHIGAN CENTRAL RAILROAD COMPANY

To the Stockholders of

THE MICHIGAN CENTRAL RAILROAD COMPANY:

The Board of Directors herewith submits its report for the year ended December 31, 1915, with statements showing the results for the year and the financial condition of the company.

The report covers the operation of mileage, as follows:

	Miles
Main line	270.07
Proprietary line	8.15
Leased lines	1,428.64
Lines operated under trackage rights	96.14
Total road operated (as shown in detail on another page)	1,803.00

The increase of 2.96 miles, as compared with the previous year, is due to acquiring trackage rights over the Manistee and North Eastern Railway at Grayling, Michigan.

There was no change in capital stock during the year, the amount authorized and outstanding being $18,738,000.00.

The funded debt outstanding December 31, 1914, was		$44,382,396.99
It has been increased during the year by the issue and sale of Michigan Central first mortgage 3½% bonds, payable May 1, 1952, being the remainder of the total authorized issue of $18,000,000.00	$4,000,000.00	
By certificates issued under the New York Central Lines equipment trust agreement of 1913	741,000.00	4,741,000.00
		$49,123,396.99

It has been decreased during the year by payment of pro-rata of installments on account of New York Central Lines equipment trust certificates

Trust of 1907, due November, 1915	$260,425.45
Trust of 1910, due January 1915 and 1916	736,039.44
Trust of 1912, due January 1915 and 1916	303,421.80
Trust of 1913, due January 1915 and 1916	432,790.69
	$1,732,677.38

Michigan Central—Jackson, Lansing and Saginaw 3½% gold bonds of 1951 purchased and cancelled by the Trustees of the Land Grant Fund of the Jackson, Lansing & Saginaw Railroad Company 6,000.00 1,738,677.38

Total funded debt December 31, 1915 (detail on another page) $47,384,719.61

The changes in the road and equipment account during the year, and as shown in detail on another page, were as follows:

The amount charged to December 31, 1914, was	$56,674,846.65
Expenditures during the year for additions and betterments —road	202,818.84
	$56,877,665.49
Less net excess of value of equipment retired, over cost of new equipment purchased, and additions and betterments to equipment	538,016.62
Total amount charged to December 31, 1915	$56,339,648.87

The changes in the account showing amount of improvements on leased railway property during the year, and as shown in detail on another page, were as follows:

The amount charged to December 31, 1914, was	$18,027,797.24
Expenditures during the year, for additions and betterments —road	401,657.38
	$18,429,454.62
Less reimbursements for expenditures in prior years, etc.	550,883.05
Total amount charged to December 31, 1915	$17,878,571.57

There were sold during the year $1,500,000.00 first mortgage 4% bonds of the Toledo Canada Southern and Detroit Railway Company, part of the proceeds of which have been used to reimburse The Michigan Central Railroad Company for expenditures heretofore made for improvements to the property of the Toledo Canada Southern and Detroit Railway Company, and the balance will be used for future improvements to the property of that company.

On March 4, 1915, the balance of $500,000.00 due on note in favor of the New York Chicago and St. Louis Railroad Company was paid, releasing the 10,000 shares of Canada Southern stock, deposited as collateral thereto.

For the purpose of reimbursing the treasury for expenditures for extensions, improvements and betterments to its property, this company, in February, 1915, sold the remaining $4,000,000.00 of the authorized amount of $18,000,000.00 of its first mortgage 3½% bonds due May 1, 1952. On March 2, 1915, it issued its one year promissory notes for $3,000,000.00, bearing interest at rate of 4½% per annum. The company's 4½% notes aggregating $6,000,000.00, which matured on March 2, 1915, were retired.

On March 15, 1915, this company issued additional one year notes for $1,000,000.00, bearing interest at rate of 4½% per annum.

During the year there were issued and sold under the New York Central Lines equipment trust agreement dated January 1, 1913, certificates aggregating $741,000.00, all of which were allotted to this company to be used in the acquisition of additional equipment costing approximately $835,560.00. Of $24,000,000.00 of certificates authorized, under this agreement, $23,179,000.00 have been issued and sold. The balance amounting to $821,000.00, matured before sale, and were cancelled. This company's allotment of the total certificates issued was $3,435,814.50, of which $2,938,744.10 are outstanding.

On October 13, 1915, the Board of Directors authorized the execution of an agreement dated October 1, 1915, for the establishment of the Michigan Central Railroad Equipment Trust of 1915. This agreement provides for an issue of $4,500,000.00, of equipment trust certificates, bearing interest at rate of 5% per annum, which amount is not to be in excess of 90% of the cost of the equipment to be furnished under the terms of said agreement. The certificates, none of which had been sold at the close of the year 1915, are to be paid in fifteen annual installments, the first installment being due October 1, 1916.

On May 10, 1915, this company purchased, at par, 22 shares of the capital stock of The Toronto Hamilton and Buffalo Railway Company, being its pro-rata of 125 additional shares issued upon the merger of The Toronto Hamilton and Buffalo Railway Company with The Erie and Ontario Railway Company.

On November 12, 1915, this company purchased, at par, 193 shares of the capital stock of The Detroit Delray and Dearborn Railroad Company, increasing this company's holdings to 2,603 shares, representing all shares outstanding. The proceeds from this sale were used by the issuing company in reducing its indebtedness to this company for construction expenditures.

On July 1, 1915, the rights of this company, and The Canada Southern Railway Company, to use the London and Port Stanley Railway between St. Thomas and London, Ontario, were terminated by the London Railway Commission, which had acquired the use and possession of the London and Port Stanley Railway and had undertaken to electrify and operate the said road for the owner, the City of London. Negotiations were at once entered into with the London Railway Commission and an agreement was made, dated December 23, 1915, under the terms of which the London Railway Commission will haul the freight traffic of this company between St. Thomas and London, Ontario, and will perform all switching movements on this company's terminals (formerly London and Southeastern Railway) at London for a period of twenty-one years, or for thirty years if permitted by Canadian statutes.

On December 29, 1915, this company exercised the option which The Canada Southern Railway Company had under lease, dated July 23, 1896, from the London and Southeastern Railway Company, to buy for $75,000.00, the lands, buildings, and rights of that company at London, Ontario, paid the consideration and obtained their conveyance to The Canada Southern Railway Company. The London and Southeastern Railway Company's property, which constitutes the terminals of the Canada Southern Railway at London, is now in the possession and use of this company as lessee of the Canada Southern Railway.

SUMMARY OF FINANCIAL OPERATIONS AFFECTING INCOME

	1915	1914	Increase
OPERATING INCOME	1,803.00 *miles*	1,800.04 *miles*	or Decrease,
RAILWAY OPERATIONS	*operated*	*operated*	2.96 *miles*
Revenues	$36,540,665.12	$33,464,968.45	$3,075,696.67
Expenses	25,727,487.11	25,181,483.72	546,003.39
NET REVENUE FROM RAILWAY OPERATIONS	$10,813,178.01	$8,283,484.73	$2,529,693.28
Percentage of expenses to revenues	(70.41%)	(75.25%)	—(4.84%)
RAILWAY TAX ACCRUALS	$1,522,935.96	$1,598,350.12	—$75,414.16
UNCOLLECTIBLE RAILWAY REVENUES	4,640.76	3,339.04	$1,301.72
TOTAL	$1,527,576.72	$1,601,689.16	—$74,112.44
RAILWAY OPERATING INCOME	$9,285,601.29	$6,681,795.57	$2,603,805.72
NON-OPERATING INCOME			
Joint facility rent income	$233,443.89	$227,227.12	$6,216.77
Miscellaneous rent income	3,705.25	1,915.87	1,789.38
Miscellaneous non-operating physical property	1,533.72	663.13	870.59
Separately operated properties—profit	610.33	225.28	385.05
Dividend income	469,425.50	488,159.50	—18,734.00
Income from funded securities	47,600.00	46,880.00	720.00
Income from unfunded securities and accounts	170,797.39	160,143.56	10,653.83
Miscellaneous income	1,367.07	1,148.21	218.86
TOTAL NON-OPERATING INCOME	$928,483.15	$926,362.67	$2,120.48
GROSS INCOME	$10,214,084.44	$7,608,158.24	$2,605,926.20
DEDUCTIONS FROM GROSS INCOME			
Hire of equipment—debit balance	$1,566,500.95	$1,364,848.81	$201,652.14
Joint facility rents	535,479.00	569,131.09	—33,652.09
Rent for leased roads	3,444,650.66	3,402,187.00	42,463.66
Miscellaneous rents	10,491.72	14,985.36	—4,493.64
Miscellaneous tax accruals	2,249.62	2,675.68	—426.06
Separately operated properties—loss	16,283.69	9,318.90	6,964.79
Interest on funded debt	1,389,594.52	1,286,005.92	103,588.60
Interest on unfunded debt	316,799.94	543,024.33	—226,224.39
Miscellaneous income charges	5,076.97	1,561.71	3,515.26
TOTAL DEDUCTIONS FROM GROSS INCOME	$7,287,127.07	$7,193,738.80	$93,388.27
NET INCOME	$2,926,957.37	$414,419.44	$2,512,537.93
DISPOSITION OF NET INCOME			
Dividend appropriation of income (4%)	$749,520.00	$749,520.00	.....
Appropriated for additions and betterments			
Michigan Central Railroad	4,110.57	.....	$4,110.57
Leased lines	109,065.64	.....	109,065.64
TOTAL APPROPRIATIONS	$862,696.21	$749,520.00	$113,176.21
INCOME BALANCE TRANSFERRED TO TO CREDIT OF PROFIT AND LOSS	$2,064,261.16	†$335,100.56	$2,399,361.72

AMOUNT TO CREDIT OF PROFIT AND LOSS DECEMBER 31, 1914		$12,361.195.21
ADD:		
Surplus for the year 1915	$2,064,261.16	
Reimbursement for improvements on TCS&D Ry prior to July 1, 1907	126,157.48	2,190.418.64
		$14,551,613.85
DEDUCT:		
Dividend appropriation of surplus (1%)	$187,380.00	
Adjustment of tolls, Western Union Telegraph Co., years 1908 to 1913 inclusive	64,847.05	
Depreciation unaccrued prior to July 1, 1907 on equipment retired during 1915	188,816.64	
Transferred to accrued depreciation account	227,968.03	
Construction expenditures, Canada Southern Ry., year 1914 assumed by MCRR Co.	44,323.15	
Commission, expenses and 1915 proportion of discount, MCRR 3½% Bonds of 1952	93,010.20	
Discount, commission and expenses, MCRR equipment trust of 1915	27,009.80	
Discount, commission and expenses, New York Central Lines equipment trust of 1913	30,453.39	
Abandoned property	28,460.25	
Adjustment of sundry accounts, including uncollectible items (net)	20,370.89	912,639.40
BALANCE TO CREDIT OF PROFIT AND LOSS DECEMBER 31, 1915		$13,638,974.45

†Deficit.

The total gross revenue from railway operations for the year was $36,540,665.12, an increase of $3,075,696.67, due principally to generally improved business conditions throughout the country during the year, and to certain increased transportation rates approved by the Interstate Commerce Commission.

The freight revenue was $23,050,121.71, an increase of $2,332,849.47, due to the greater volume of traffic handled, and to increased freight rates on certain commodities.

The passenger revenue was $9,386,421.09, an increase of $505,808.06, due to increase in rates for interstate passenger traffic.

Revenue from transportation of mail was $505,698.97, an increase of $36,439.38, due to increased compensation, effective July 1, 1915, as a result of the reweighing of mail matter during the early part of the year.

Express revenue was $1,397,587.61, a decrease of $45,556.01, due to parcel post competition, reduction of express rates, and accounting adjustments.

Revenues from all other sources, including incidental and joint facility operating revenues were $2,200,835.74, an increase of $246,155.77. Principal among the items showing increases were, switching $117,088.56, stock yards $49.375.57, grain elevators $32,712.05, and rents of building and other property $26,363.29.

The total railway operating expenses were $25,727,487.11, an increase of $546,003.39, as per detail on following pages. By groups the fluctuations were as follows:

Increases:		
Maintenance of way and structures		$904,864.80
Maintenance of equipment		415,790.15
General		55,010.34
		$1,375,665.29
Decreases:		
Traffic	$40,743.68	
Transportation	774,571.42	
Miscellaneous operations	14,346.80	829,661.90
Net increase		$546,003.39

The increase in maintenance of way and structures is accounted for principally in the items covering renewals of rails and ties.

In maintenance of equipment the increase is largely attributable to the greater number of freight cars receiving a general overhauling and heavy repairs as compared with the previous year.

The increase in general expenses is mainly due to law and valuation expenses, and payments for pensions.

The decrease in traffic expenses is due to a general reduction in nearly all items of expense in this group, principally attributable to a practical stopping of immigration traffic because of the European war and reduced advertising expenses.

The decrease in transportation expenses is principally due to the use of larger locomotives on the main line and Mackinaw division, and to a greater use of superheaters, thus producing increased efficiency and decrease in fuel consumption, and is also due to a closer supervision over yard operation expenses and to a large decrease in payments for loss and damage.

The decrease in miscellaneous operations is largely due to a falling off in amount of business in dining and buffet service, partly offset by an increased expense for grain elevators, owing to the opening of the new elevator at Kensington, Illinois, in June 1914, the increase representing expenses in the early part of this year for which there was no corresponding outlay in the same period of the preceding year.

The railway tax accruals for the year were $1,522,935.96, a decrease of $75,414.16 as compared with the previous year, due principally to a reduction in rate of ad valorem tax in the state of Michigan, partly offset by war tax in the Dominion of Canada.

In the operation of the pension department, fifty-two employees were retired and placed upon the pension rolls. Of these retirements, thirty-eight were authorized because of the attainment of seventy years of age, and fourteen because of total and permanent physical disability. Twenty-seven pensioners died during 1915, and at the close of the year two hundred and fifty-five retired employees were carried upon the pension rolls. The average monthly pension allowance to these employees was $21.39, and the total amount paid in pension allowances during the year was $67,715.44.

The following appointments were effective during the year:

February 1, Louis J. Brinkman, Freight Claim Agent
March 1, George E. Parks, Mechanical Engineer
March 1, Frank W. Stevens, General Valuation Counsel
May 1, Thomas J. Burns, Superintendent of Rolling Stock
May 12, Henry Russel, Vice-President

Acknowledgment is hereby made to officers and employees for faithful and efficient service.

For the Board of Directors,
ALFRED H. SMITH,
President.

THE CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS

To the stockholders of

THE CLEVELAND CINCINNIATI CHICAGO & ST LOUIS RAILWAY COMPANY:

The Board of Directors herewith submits its report for the year ended December 31, 1915, with statements showing the results for the year and the financial condition of the company.

The mileage embraced in the operation of the road is as follows:

	Miles
Main line and branches owned	1,687.87
Proprietary lines	126.09
Leased lines	204.40
Operated under contract	201.37
Trackage rights	165.15
Total road operated	2,384.88

This is an increase as compared with a similar table in last year's report of 3.64 miles, due to remeasurement of the entire line in connection with the valuation study.

A statement showing in detail the mileage of road operated will be found on another page.

There was no change in the capital stock during the year, the amounts authorized and issued to December 31, 1915, being as follows:

Preferred stock authorized		$10,000,000.00
Common stock authorized		50,000,000.00
Total preferred and common stock authorized		$60,000,000.00
Preferred stock issued	$10,000,000.00	
Common stock issued	47,056,300.00	57,056,300.00
Balance common stock authorized but not issued, December 31, 1915		$2,943,700.00

The merger with this company of the Cincinnati & Southern Ohio River Railway Company, the Cincinnati Wabash & Michigan Railway Company, the Fairland Franklin & Martinsville Railroad Company, and the White Water Railroad Company, reference to which was made in the report for the year 1913, was completed in June, 1915.

The funded debt unmatured outstanding December 31, 1914, was		$95,796,667.22
It has been increased during the year as follows:		
Liability in connection with purchase money lien—Line Springfield, Ohio, to Indianapolis, Indiana, not heretofore recorded on the books of the company (see contra charge in table of changes in road and equipment account)	$5,000,000.00	
Certificates issued under the Big Four Railway Equipment Trust Agreement of 1915	1,725,000.00	
Notes issued in part payment for equipment acquired under Big Four Equipment Trust of 1914	191,280.70	6,916,280.70
		$102,712,947.92
It has been decreased during the year as follows:		
Pro rata equipment trust certificates retired January 1, 1915	$476,249.73	
Pro rata equipment trust certificates retired June 1, 1915	115,000.00	
Pro rata equipment trust certificates retired July 1, 1915	258,000.00	
Pro rata equipment trust certificates retired November 1, 1915	246,689.81	
Pro rata equipment trust certificates retired January 1, 1916	476,249.73	
C I St L & C Ry Co general first mortgage bonds retired	71,000.00	
C I St L & C Ry Co first mortgage bonds retired	7,000.00	
Retirement of notes issued in part payment for equipment purchased under Big Four Equipment Trust of 1914	500,959.95	
C C C & St L (St L Div) first collateral trust mortgage bonds purchased for sinking fund	34,000.00	2,185,149.22
Total funded debt outstanding December 31, 1915 (detail on another page)		$100,527,798.70

Under Big Four Railway Equipment Trust Agreement of January 1, 1915, there were acquired 1915 freight train cars and 18 locomotives at an aggregate cost of $2,161,672.94. Trust certificates to the total amount of $1,725,000.00 were issued for not to exceed eighty per cent (80%) of the cost of the equipment, and the remainder of the cost was paid in cash.

The changes in the road and equipment account during the year were as follows:

ROAD		
Charges:		
Account companies merged—		
Cincinnati Wabash and Michigan Railway	$4,031,793.37	
Cincinnati and Southern Ohio River Railway	133,526.94	
Fairland Franklin and Martinsville Railroad	50,000.00	
White Water Railroad	661,175.02	$4,876,495.33
To indicate in the investment account property Springfield, Ohio, to Indianapolis, Indiana, acquired subject to purchase money lien (see table of changes in funded debt) and not heretofore so included		5,000,000.00
Additions and betterments per detail on another page		1,045,384.46
Total		$10,921,879.79
EQUIPMENT (detail on another page)		
Charges:		
Trust equipment	$3,207,288.45	
Owned equipment	480,993.83	
	$3,688,282.28	
Credit account value of equipment retired	1,389,300.64	
Net total		2,298,981.64
Grand total		$13,220,861.43

Reference was made in the report for last year to work being performed under Section 19-A of the Act to Regulate Commerce, which provides that the Interstate Commerce Commission shall investigate and ascertain the value of all property owned and used by railroad companies. This work was actively prosecuted during the year. Four track and roadway parties, two terminal roadway parties, a signal party, two bridge parties, two building parties, a telegraph party and several mechanical parties were simultaneously engaged in this work during the summer and fall. The work of taking the inventory has been completed with the exception of the buildings on about three hundred miles of the line. The railway company's engineering forces are now engaged in perfecting the new maps and profiles and making a check of the Government's inventory notes. It has been necessary to materially increase the railway company's forces in order to prepare statements and furnish data required by the various valuation orders of the Commission.

SUMMARY OF FINANCIAL OPERATIONS AFFECTING INCOME

	1915	1914	Increase or Decrease
OPERATING INCOME	2,384.88	2,381.24	3.64 *miles*
RAILWAY OPERATIONS	*miles operated*	*miles operated*	
Revenues	$38,364,086.93	$35,365,690.61	$2,998,396.32
Expenses	27,528,366.76	28,954,969.13	—1,426,602.37
NET REVENUE FROM RAILWAY OPERATIONS	$10,835,720.17	$6,410,721.48	$4,424,998.69
Percentage of expenses to revenues	(71.76%)	(81.87%)	—(10.11%)
RAILWAY TAX ACCRUALS	$1,514,131.44	$1,526,714.54	—$12,583.10
UNCOLLECTIBLE RAILWAY REVENUES	9,718.54	8,608.66	1,109.88
	$1,523,849.98	$1,535,323.20	—$11,473.22

RAILWAY OPERATING INCOME	$9,311,870.19	$4,875,398.28	$4,436,471.91
MISCELLANEOUS OPERATIONS			
Revenues	$16,650.67	$16,518.48	$132.19
Expenses and taxes	14,417.52	13,187.00	1,230.52
MISCELLANEOUS OPERATING INCOME	$2,233.15	$3,331.48	—$1,098.33
TOTAL OPERATING INCOME	$9,314,103.34	$4,878,729.76	$4,435,373.58
NON-OPERATING INCOME			
Joint facility rents	$440,946.93	$400,607.05	$40,339.88
Miscellaneous rents	149,955.76	149,214.71	741.05
Miscellaneous non-operating physical property	80,698.21	77,407.69	3,290.52
Dividend income	62,149.65	61,997.90	151.75
Income from funded securities	229,674.03	127,350.59	102,323.44
Income from unfunded securities and accounts	67,607.58	85,344.05	—17,736.47
Miscellaneous income	103,803.18	31,276.20	72,526.98
TOTAL NON-OPERATING INCOME	$1,134,835.34	$933,198.19	$201,637.15
GROSS INCOME	$10,448,938.68	$5,811,927.95	$4,637,010.73
DEDUCTIONS FROM GROSS INCOME			
Hire of equipment—debit balance	$556,183.62	$1,706,711.86	—$1,150,528.24
Joint facility rents	562,779.10	613,538.58	—50,759.48
Rent for leased roads	571,041.00	575,901.00	—4,860.00
Miscellaneous rents	141,370.77	141,587.28	—216.51
Miscellaneous tax accruals	423.80	408.64	15.16
Separately operated properties—loss	96,024.20	95,560.19	464.01
Interest on funded debt	4,357,855.78	4,147,836.91	210,018.87
Interest on unfunded debt	731,254.00	485,072.14	246,181.86
Amortization of discount on funded debt	16,538.66	.....	16,538.66
Miscellaneous income charges	10,736.56	5,729.70	5,006.86
TOTAL DEDUCTIONS FROM GROSS INCOME	$7,044,207.49	$7,772,346.30	—$728,138.81
NET INCOME	$3,404,731.19	$1,960,418.35*	$5,365,149.54
DISPOSITION OF NET INCOME			
Income applied to sinking fund	$27,677.00	$13,269.00	$14,408.00
Income appropriated for investment in physical property	56,124.94	.....	56,124.94
TOTAL APPROPRIATIONS	$83,801.94	$13,269.00	$70,532.94
SURPLUS TRANSFERRED TO CREDIT OF PROFIT AND LOSS	$3,320,929.25	$1,973,687.35*	$5,294,616.60

*Deficit.

Amount to debit of profit and loss December 31, 1914		$3,668,920.53
ADD:		
Unaccrued depreciation prior to 1907 on equipment retired during the year 1915	$497,961.59	
Amount transferred to accrued depreciation account	183,064.90	
Settlement with Western Union Telegraph Co. for excess telegraphing 1906 to 1913	110,778.05	
Value of property abandoned	31,443.69	823,248.23
		$4,492,168.76
DEDUCT:		
Surplus for year 1915	$3,320,929.25	
Adjustment of sundry accounts	139,666.33	3,460,595.58
BALANCE TO DEBIT OF PROFIT AND LOSS DECEMBER 31, 1915		$1,031,573.18

The gross railway operating revenues for the year, $38,364,086.93, were the greatest in the history of the company, and were $2,998,396.32 in excess of 1914. Transportation revenue increased $3,120,130.45, while incidental and joint facility revenue decreased $121,734.13.

Freight revenue was $26,510,832.20, an increase of $3,074,621.45, or 13.12 per cent, due principally to improved business conditions during the latter part of the year, also to the increases in freight rates approved by the Interstate Commerce Commission and by the State of Ohio in the "Five Per Cent Case," effective early in the year. The principal classes of articles transported show increases in tonnage over 1914, with the exception of hay, fruit and vegetables, and other agricultural products, which were affected by crop conditions, and stone, sand and other like articles, which decreased owing to the general depression in the building trades in the early months.

Total revenue tonnage carried was 27,483,677, an increase of 1,405,787 tons. The average revenue per ton per mile was 5.57 mills, an increase of .26 mills, due to proportionately greater movement of high class tonnage and to the increase in freight rates. The average amount received per ton of freight was 96.5 cents as compared with 89.9 cents in 1914, and the average distance haul per ton of revenue freight was 173.3 miles, an increase of 3.9 miles. Revenue train loading for the year was 589 tons per train mile, an increase of 41 tons, or 7.48 per cent, and freight revenue per train mile was $3.28, an increase of $0.37.

Passenger revenue for the year was $8,514,689.45, a decrease of $74,322.69, or .87 per cent, made up of a decrease in interline revenue of $163,011.09, partially offset by an increase in local business of $88,688.40. The average distance per passenger carried was 52.3 miles, a decrease of 3.4 miles, and the average amount received from each passenger was $1.047, a decrease of $.040. The decrease in passenger revenue was the result of a general falling off in travel during the first eight or nine months of the year, due to the business depression throughout the country, and particularly in the Southern states. Improvement was shown during the closing months of the year, and the prospects are favorable for a good passenger business in 1916. The increase in interstate passenger rates approved by the Interstate Commerce Commission produced some additional revenue, but the two-cent fare laws in Indiana, Ohio, Illinois and Michigan have prevented increases on intrastate traffic and have deprived the company of much of the benefits it would otherwise have received from a general advance in passenger rates to the basis approved by the Interstate Commerce Commission, for the reason that the existence of the two-cent fare laws in each state encourages the buying to and re-buying from state lines, resulting in lower fares between certain points than would be obtained upon the basis of two and one-half cents per mile.

Mail revenue for the year was $829,450.35, an increase of $57,090.93, or 7.39 per cent, due to adjustment of mail pay, effective July 1, to compensate for the increased weight of mail being carried as disclosed by the quadrennial weighing of mails which took place early in the year.

Revenue from express traffic was $952,713.14, a decrease of $468.27. There was a heavy decrease in express revenue during the early part of the year due to three factors: Parcel post competition, reduction in rates ordered by the Interstate Commerce Commission and general business depression. Later in the year express traffic improved, due to general betterment in business conditions. The Interstate Commerce Commission, effective September 1st, approved revision in the rate structure prescribed for express companies, which revision has also been adopted by the states of Ohio, Michigan and Illinois but not by Indiana, and while it makes no change in the 100-pound charge between various points, this revision resulted in an estimated increase of 3.84 per cent in the gross express revenue.

Incidental and joint facility revenues decreased $121,734.13, of which $40,048.92 is in dining and buffet, $23,496.05 in demurrage and $36,761.61 in miscellaneous, the balance being spread over the remaining accounts.

Railway operating expenses for the year were $27,528,366.76, a decrease of $1,426,602.37, which taken with an increase in railway operating revenues of $2,998,396.32, produces an increase in net revenue of $4,424,998.69. By groups, the fluctuations in expenses for the year were as follows:

Maintenance of way and structures—decrease	$322,661.58
Maintenance of equipment—decrease	225,969.35
Traffic—decrease	16,105.17
Transportation—rail line—decrease	872,404.55
Miscellaneous operations—decrease	14,409.35
General—(including Government valuation)—increase	95,946.49
Transportation for investment—credit—increase	70,998.86
Net decrease	$1,426,602.37

Many items in the maintenance of way group show substantial decreases, attributable to the heavy outlay in 1914 in connection with rehabilitation work made necessary by the flood of 1913.

Maintenance of equipment expenses decreased $225,969.35.

Traffic expenses decreased $16,105.17.

Transportation-rail line expenses decreased $872,404.55, distributed among substantially all of the accounts of this group. Large items of decrease are in fuel for train locomotives $196,817.92, loss and damage—freight $231,180.88, and injuries to persons, $48,547.65.

Expenses of conducting miscellaneous operations decreased $14,409.35, wholly in dining and buffet service.

General expenses increased $95,946.49, due mainly to expenses in connection with the Federal valuation.

Railway tax accruals for the year decreased $12,583.10, of which $9,986.91 is decrease in tax on gross earnings in the State of Ohio.

Railway operating income for the year was $9,311,870.19, and miscellaneous operating income was $2,233.15, making total operating income $9,314,103.34, an increase of $4,435,373.58. Non-operating income was $1,134,835.34, an increase of $201,637.15.

The gross income was $10,448,938.68, an increase of $4,637,010.73.

Deductions from gross income decreased $728,138.81. This is due to the additional equipment purchased and put in operation, thereby decreasing the car hire balance in interchange.

The surplus for the year was $3,320,929.25, as compared with a deficit in 1914 of $1,973,687.35, an increase of $5,294,616.60.

During the year there was charged to income the company's proportion of the deficit resulting from the operation of the Central Indiana Railway Company for the year amounting to $62,953.46, or $13,092.67 less than the previous year.

The operations of the Kankakee and Seneca Railroad (for which separate accounts are maintained) show revenues for the year $83,879.27, operating expenses, taxes, and additions and betterments $139,530.25, deficit $55,650.98, one-half of which, $27,825.50, was assumed by this company and charged to income in 1915.

The Mount Gilead Short line (for which separate accounts are maintained) show revenues for the year $5,575.50, operating expenses and taxes $10,954.24, non-operating income $133.50, deficit $5,245.24, all of which was charged to income in 1915.

The summary of financial operations affecting income includes the operations of the Peoria and Eastern Railway, Indianapolis, Indiana, to Peoria, Illinois. Separate accounts for this line are maintained, and the operations for the year 1915 show revenues amounting to $2,183,962.60, operating expenses and taxes $1,750,567.56, operating income $433,395.04, non-operating income $363,999.94, gross income $797,394.98, deductions from gross income $607,113.00, surplus $190,281.98. After sundry adjustments of profit and loss items there remained $163,778.40, which was applied in accordance with the operating agreement in reduction of amount due this company for advances in previous years, leaving a balance of such indebtedness of $384,554.51.

The financial condition and results from operation for the year for The Cincinnati Northern Railroad Company are shown in a separate report.

The Pension Department retired and placed upon the pension rolls 59 employees during the year. Forty-two of these were authorized because of the attainment of seventy years of age, and 17 because of total and permanent disability. Twenty-five pensioners died during 1915. The total amount paid in pension allowances was $72,595.71.

Appointments during the year were as follows:

On March 1, Charles A. Paquette, Chief Engineer.
On March 1, Hadley Baldwin, Assistant Chief Engineer.
On March 1, Frank W. Stevens, General Valuation Counsel.
On June 15, Daniel M. Bowman, General Passenger Agent.
On June 15, Freeman H. Wipper, Assistant General Passenger Agent.

Thanks and appreciation are extended to the officers and employees for their loyal and efficient service during the year.

For the Board of Directors,
ALFRED H. SMITH, *President.*